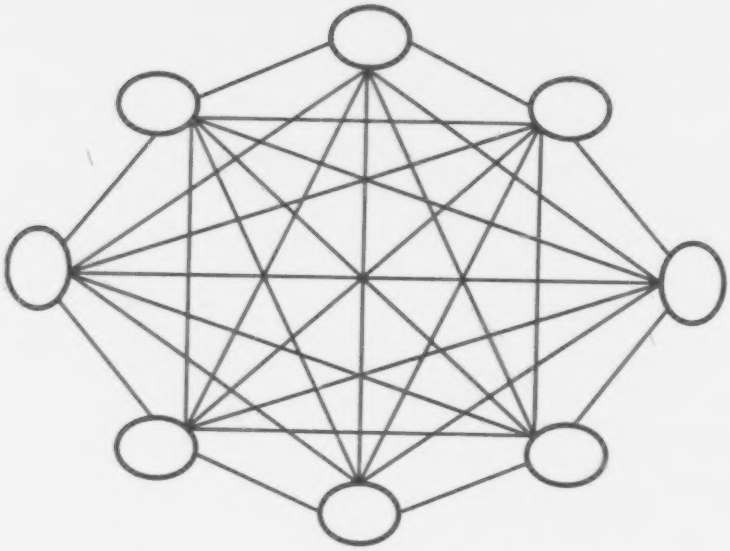
A8640-3

1991 First Edition

Telecommunications Market Review And Forecast



North
American
Telecommunications
Association

New in 1991, NATA is expanding its annual report on the telecommunications industry to include a second edition. This first edition covers all the market segments included in last year's publication and is being released at the time of the year NATA traditionally releases its annual report--late fall of 1990. The second edition will be released in May 1991, and will contain new sections on the interconnect industry, third-party distribution of network services, and the emerging market for videoconferencing equipment. The second edition will also re-examine the 1990 results and 1995 forecasts contained in the first edition.

Research and Analysis
Eric G. Nelson
Director, Market Research and
Government Relations

Production Support
Thomas B. Goehner
Gail Blaize

Editorial Support
Mary Lou Coffman
Susan Ryba
Lee Biederman

Copyright (C) 1990 by the North American Telecommunications Association
2000 M Street, N.W., Suite 550
Washington, D.C. 20036
(202) 296-9800
ISBN 0-940919-19-2

FOREWORD

The telecommunications marketplace is fast becoming a compromise between what users demand and what technology can provide. Many of the technological developments of the 1990 telecommunications marketplace will bring dramatic improvements to the way residential and business consumers communicate. For instance, ISDN, with its host of benefits, has become commercially available, and, late this year, AT&T and Rochester Telephone began trialing ISDN to residential consumers. The latest technologies to capture the interest of business users and manufacturers include cordless/wireless communications and videoconferencing. Furthermore, even many of the more mature product areas such as fax, voice processing, and data communications found new applications and expanded responsibilities. In short, the telecommunications marketplace is one where the only constant is change.

The North American Telecommunications Association (NATA) is uniquely positioned to ensure that the changes taking place in the telecommunications marketplace are rooted in an environment that promotes fair and open competition. NATA is a national trade association representing manufacturers and distributors of communications, computer, and office equipment, as well as related service and information providers. The Association was founded in 1970 by Tom Carter and other farsighted businessmen dedicated to the establishment and flourishing of strong manufacturer and distributor industries independent from the Bell System. Through NATA's efforts, these companies have grown and matured into a multibillion dollar industry bringing business and residential consumers a full range of sophisticated communications products and services.

Increasingly recognized as the best single industry source for vital market intelligence, **The Telecommunications Market Review and Forecast** contains statistical and analytical descriptions of the full range of telecommunications sectors. The report is based on data collected by the NATA Market Research Department from government and private sources. Market trends have been confirmed by numerous industry representatives and analysts. This report represents the best efforts of the NATA Market Research Department to prepare a useful guide to the complex and dynamic telecommunications marketplace. NATA staff is available to answer any questions relating to the statistics or analyses presented herein at 1-800-538-6282 or 202-296-9800.

Eric G. Nelson
Director, Market Research

TABLE OF CONTENTS

Page

Executive Summary 1
  Industry Overview 3
  Customer Premises Equipment 6
  Network Equipment 8
  Telecommunications Services 9

U.S. Telecommunications Equipment Manufacturing Industry 13

International Developments 24
  U.S. Foreign Trade Activities:
    Overview 27
    Managing Telecommunications Trade 29
    Implications of U.S. Policies 31
  1992 Economic Integration of the European Community 33
  Implications of Political Changes in Eastern Europe 36
  Other International Trends 39

Telecommunications Services Overview 45

Local Exchange Market 55
  Overview 57
  Regulated Local Exchange Companies 58
    Bypass 59
    CPE Distribution 60
    ISDN 60
    Service Pricing Regulatory Trends 61
    Enhanced Services 61
    Sales Agency 62
    International Opportunities 62

Interexchange Market 83

Network Equipment Market 93

Customer Premises Equipment Overview 101
  CPE Purchaser Profile 103
  ISDN 104
  Systems Integration 106
  Secondary Equipment 107
  Centrex CPE 110

Selected CPE Markets 113

PBX/Centrex Market 115
Introduction 115
Market Review 117
PBX-Centrex Installed Base 117
Manufacturer Trends 118
Key/Hybrid Market 137
Introduction 137
Market Review 138
Installed Base 139
AT&T Dumping Case 140
Data Communications Equipment Market 151
Introduction 151
Market Review 153
Facsimile Terminal Market 157
Introduction 157
Market Review 158
Consumer Telecommunications Market 163
Introduction 163
Market Review 163
Call/Voice Processing Market 169
Introduction 169
Market Review 170
Public Payphone Market 177
Introduction 177
Market Review 180

Mobile Communications Market 185
Introduction 187
Cellular Radiotelephony 187
Cellular Market Review 188
Radio Paging Networks 191
Paging Market Review 191

FIGURES

1. Value of the U.S. Telecommunications Equipment Market, 1984-1995 12
2. Annual Growth Rates of U.S. Manufacturers' Shipments of Selected Telecommunications Equipment, 1984-1995 18
3. Manufacturers' Shipments, Material Costs, and Year-End Inventories of Telecommunications Equipment 18
4. Comparison of Domestic, Import, and Export Prices for Telephone and Telegraph Equipment, 1985-1989 19
5. U.S. Trade Balance in Telecommunications Equipment,

1984-1988 42
6. Telecommunications Services Market, by Type of Service 51
7. ISDN Trials 52
8. 1988 Local Exchange Services Market, by Type of Service 64
9. 1988 RBOC Revenue, by Source 64
10. 1988 Revenue Breakdown, by RBOC 65
11. 1988 Net Income by RBOC 65
12. Enhanced Services Scoreboard, by RBOC 66
13. 1988 Long Distance Market, by Carrier 88
14. 1988 Long Distance Market, by Type of Service 88
15. Network Equipment Market, 1984-1995 97
16. 1988 Central Office Switch Market, by Manufacturer 97
17. PBX-Centrex Price Comparison over a Five-Year Period for a 50-line System 121
18. 1989 PBX User Ratings 121
19. 1989 Centrex User Ratings 122
20. PBX Market, by System Size, 1984-1995 122
21. PBX Shipments by Distribution Channels, 1988 and 1989 123
22. PBX-Centrex Installed Base Development 1984-1995 123
23. PBX-Centrex Lines in Place, by RBOC, 1988 124
24. RBOC Share of 1989 PBX Market Within Own Region 124
25. PBX Comparative Market Penetration by End-Use Industry, 1988 125
26. Centrex Comparative Market Penetration by End-Use Industry, 1988 125
27. PBX Prices, Per Line, 1984-95 126
28. 1989 Company-specific PBX Distribution Channels 126
29. 1989 Manufacturer Market Shares of PBX Line Shipments 127
30. Vendor Control Over 1989 Installed PBX Customer Base 127
31. PBX Shipments Breakdown, by Type of Installation 128
32. PBX Feature Usage 128
33. Total Key Station Shipments, 1984-1995 142
34. Key/Hybrid Station Shipments, by Type, 1984-1995 142
35. Key/Hybrid Shipments, by Distribution Channel, 1988 and 1989 143
36. Key/Hybrid Installed Base, 1984-95 143
37. 1989 Key System Market, By End-use Industry 144
38. Key/Hybrid Manufacturers' Market Shares of Stations Shipped, 1989 and 1990 144
39. RBOC Share of Key Systems Market Within Own Region 145
40. 1989 Company Specific Key System Distribution Channels 145
41. Vendor Control of the 1989 Key/Hybrid Installed Base 146
42. 1989 Key/Hybrid Shipments Breakdown, by Type of Installation 146
43. Data Communications Equipment Market, 1984-1995 155
44. Facsimile Terminal Market, by Type, 1984-1995 160
45. 1989 Facsimile Terminal Distribution Channels 160
46. 1989 Facsimile Terminal Manufacturers' Market Shares

by Units Shipped 161
47. 1989 Facsimile Terminal Penetration, by Industry 161
48. Consumer Telecommunications Market, 1984-1995 165
49. Corded Telephone Instrument Market, by Type, 1984-1995 165
50. Call/Voice Processing Equipment Market, by Type, 1984-1995 173
51. 1989 Voice Messaging Equipment Market, by Vendor 173
52. 1989 Voice Messaging Equipment Market, by Systems, by Vendor 174
53. 1989 Voice Response Equipment Market, by Vendor 174
54. 1989 Stand-Alone ACD Market, by Vendor 175
55. Public Payphone Installed Base, 1984-1995 182
56. 1989 BOC-Owned Vs. Privately-Owned Payphones, by Region 183
51. BOC Revenues from Payphones, 1984-1995 183
52. Cellular Service Revenues and Annual Capital Investment, 1984-1995 193
53. U.S. Cellular Penetration 193
54. 1988 Pagers in Use, by Type 194
55. 1988 Pager Installed Base by Manufacturer Market Share 194

TABLES

1. Value of Selected U.S. Telecommunications Equipment Markets, 1984-1995 11
2. Value of U.S. Manufacturers' Factory Shipments of Selected Telecommunications Equipment, 1984-1989 20
3. Miscellaneous Industry Information Related to the Production of Telecommunications Equipment 21
4. Selected Operating and Financial Ratios for the Communications Equipment Producing Industry; Computer and Other Office, and All Manufacturing for 1987 22
5. Various Price Indices for Certain Telecommunications Equipment, 1985-1989 23
6. U.S. Imports of Telecommunications Equipment, 1984-1989 43
7. U.S. Exports of Telecommunications Equipment, 1984-1989 44
8. Annual Rate of Change in Major Price Indexes 68
9. Selected Financial Information of the Regional Bell Operating Companies as of December 31, 1988 69
10. Residential and Business Telephones Installed, 1985, 1990, and 1995 70
11. The Top 150 Largest Telephone Companies Reporting

to USTA, including Holding Companies 71
12. Selected Financial Information of the Top Four Independent Telephone Companies As of December 31, 1989 74
13. Outside Plant Statistics by State as of December, 31 1988 75
14. Access Lines by Type of Technology by State as of December 31, 1988 78
15. Access Lines by Type of Customer by State as of December 31, 1988 79
16. Telephone Calls and Minutes by State as of December 31, 1988 80
17. Advanced Technology Deployment by Regional Bell Operating Companies, by Year-End 1990 and 1994 81
18. Interexchange Revenues and Market Shares of Major Service Providers, 1985-1989 89
19. 1989 Long Distance Marketplace, by Industry Segment 90
20. Network Equipment Market, 1984-1995 98
21. Annual PBX Sales, by System Size, 1984-1995 129
22. PBX Installed Base and Annual Sales for the Top 30 Metropolitan Areas, 1985, 1990, and 1995 130
23. PBX Shipments by Manufacturers' Distribution Channel 131
24. Centrex-PBX Installed Base Development, 1984-1995 132
25. PBX-Centrex Lines in Place by Regional Bell Operating Company, 1986-1990 133
26. PBX-Centrex Penetration, by Industry, 1989 134
27. PBX Prices, per Line, 1984-1995 134
28. Estimated Revenues for Major PBX Manufactures, 1986-1989 135
29. 1989 PBX Market Share, by Lines Shipped, by System Size 136
30. Annual Key System Market, 1984-1995 147
31. Key/Hybrid Shipments by Manufacturers' Distribution Channel, 1986-1989 148
32. Installed Base of Key and Hybrid Market, 1984-1995 149
33. 1989 Key System Penetration, by Industry 149
34. Key/Hybrid Manufacturers' Market Share, by Stations Shipped, 1988, 1989, and 1990 150
35. Data Communications Equipment Market, 1984-1995 156
36. Facsimile Terminal Market, 1984-1995 162
37. Consumer Telecommunications Marketplace, 1984-1995 166
38. 1988 Telecommunications Retail Market, by Region 167
39. Voice/Call Processing Marketplace, 1984-1995 176
40. Public Payphone Marketplace, 1984-1995 184
41. Mobile Communications Marketplace, 1984-1995 195

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Industry Overview

The U.S. telecommunications network is comprised of 25,000 central office switches, more than a billion miles of transmission lines, almost as many miles of special service circuits, and 122 million access lines connecting customers to the public switched telephone network. The U.S. telecommunications marketplace is unique in the world for its size, sophistication, and diversity.

The total U.S. market for telecommunications equipment has grown by a compound annual growth rate of more than 9 percent a year, from $20.9 billion in 1984 to $32.7 billion in 1989. Estimates for 1990 indicate the growth rate has accelerated, with the total market amounting to $37.0 billion, 13.1 percent above 1989. Preliminary projections suggest the market will slow somewhat through the first half of the 1990s and grow at slightly more than 10 percent a year, to $58.3 billion, by 1995.

The growth in the telecommunications marketplace is being stimulated by a number of factors--some already in place, others about to be. Satellite and data communications systems, cellular mobile radio systems, and fiber optic transmission systems are being integrated into the conventional voice network, which is increasingly being converted from analog to digital systems. Most of this conversion has taken place in the transmission of signals between switches. Digitization has vastly expanded the capacity of the network for the increasing demands placed on it. One of the most significant future uses of this increased capacity is the rapidly evolving, completely digital, Integrated Services Digital Network (ISDN). ISDN will eventually combine voice, data, and video transmission in one network, giving users tremendous flexibility in communications. The implementation of ISDN will create a vast market for products and services. Some estimates put the market for ISDN-related equipment alone at about $10 billion by 1995.

In general, the telecommunications marketplace represents the compromise between what users demand and what technology can provide. A company's telecommunications network is increasingly viewed as a strategic business asset with expanding responsibilities for increasing revenue and decreasing costs. Users are growing more sophisticated in the demands they make on public and private networks. They see new services such as voice messaging, audiotex, 900, videoconferencing, packet switching, etc., as having a real impact on their profitability and are examining them aggressively to determine which products and services best match their specific needs. This heightened user awareness provides tremendous opportunities for vendors.

The U.S. telecommunications marketplace is the largest in the world and, since the AT&T divestiture, one of the most open. This openness has led to intense competition from both domestic and foreign suppliers. In 1989, approximately 21 percent of the U.S. telecommunications equipment market was supplied from abroad, up from 17 percent in 1984. This influx of foreign equipment has caused friction in the international telecommunications trade environment, since U.S. producers are not usually provided the same market access abroad as foreign suppliers are provided in the United States.

A manifestation of this friction occurred in early 1989, when the United States Trade Representative determined that Japan had breached a 1986 agreement designed to open the Japanese market to foreign suppliers. The imposition of retaliatory sanctions on certain Japanese-made products was narrowly averted at the eleventh hour when the Japanese agreed to various concessions. A similar, albeit not quite so dramatic, situation developed in 1990. Early in the year, the U.S. entered into trade negotiations with Japan to avert a crisis similar to the one in 1989. These negotiations led to an agreement obviating the need for sanctions. The terms of the agreement called for Japan to open its market for value added telecommunications services and specialized data communications equipment.

On other fronts, the U.S. government has actively promoted free trade and has initiated several measures to that end. Included are the implementation of a free trade agreement with Canada, creating the largest trading block in the world, and participation in a new round of multilateral trade negotiations under the auspices of the General Agreement on Tariffs and Trade

(GATT), the international organization tasked with managing the free world's trading system. (In December of 1990, the GATT negotiations broke down over European agricultural subsidy issues, but the negotiations may resume in early 1991.)

While on the whole the telecommunications marketplace presents tremendous opportunities for equipment and services providers, it is also a marketplace that requires intense study because of its complexity and intensely competitive environment. Not all bandwagons are destined for success. Certain firms and sectors within the industry will not survive. Acquisitions and mergers are commonplace in the industry; during 1989 there were some 100. Distributors were key objects of the acquisition trend, as manufacturers and carriers sought to secure stable outlets for their products and profitable aftermarket sales. This trend seems to have slowed somewhat during 1990, despite certain high-profile acquisitions such as Mitel's buying Coradian. In other parts of the industry, MCI acquired Telecom*USA, GTE announced its intention to buy Contel, Northern Telecom acquired the balance of the U.K.'s STC, and Siemens and Stromberg-Carlson are combining their U.S. CO switch operations.

The bulk of the market for telecommunications equipment and services is comprised of purchases by private businesses, common carriers, and residential consumers. Other important market segments include the government and private carriers.

Overall, corporate users increased their 1990 telecommunications budgets by 8 percent over 1989. In 1989, expenditures for voice communications represented 57 percent of total telecommunications expenditures, while data communications accounted for 43 percent. In 1990, voice accounted for 55 percent, while data was up to 45 percent. This trend is likely to continue as distributed processing of information becomes more prevalent and communication of data becomes an increasingly essential part of business activity.

Many business users are turning to private networks to address their telecom needs. The industries most often employing this tactic to increase their business efficiencies include manufacturing, with an estmated 8,000 private networks, wholesale/retail, with about 5,000, and financial institutions with almost 3,500.

Telephone common carriers are also increasing their expenditures. New investment by local exchange carriers in plant and equipment (including more than telecommunications equipment) in 1989 amounted to $19.8 billion, an increase of almost two percent over 1988. Added to that, in 1989 long distance carriers spent nearly $17.1 billion on new plants and equipment, up almost five percent from 1988. In total, telephone common carriers (excluding private network carriers) spent $37 billion on plants and equipment. Preliminary 1990 estimates indicate common carrier construction spending amounted to $40 billion. This gradual growth in spending is likely to increase through the mid-1990s as carriers upgrade their networks to implement ISDN and other advanced network services.

Spending by the U.S. government on telecommunications has remained fairly stable and in 1989 amounted to some $5.4 billion. The largest telecom budgets were for the Defense Department at $2.1 billion and the Department of Transportation at $1.5 billion. The next largest budget was for the Department of the Treasury at $258 million. No other agency spent more than $175 million.

Residential users are also increasing their purchases of telecommunications equipment. Residential consumers' purchases increased from $2.9 billion in 1988 to $3.0 billion in 1989 and are estimated to reach $3.2 billion in 1990. The residential segment of the marketplace will likely continue to grow moderately through the mid 1990s.

Customer Premise Equipment

The business telecommunications marketplace (including government purchases) experienced rapid growth during 1987-1990, jumping from $13 billion to $20 billion. Much of this growth is due to the soaring data communications equipment market, which increased from $5.1 billion in 1987 to $8.8 billion in 1990. This segment is likely to continue to expand at a brisk pace as distributed processing becomes ubiquitous and remote data entry, such as credit card validation terminals and point-of-sale terminals, becomes increasingly popular.

Other segments of the business telecommunications marketplace experiencing rapid growth include the facsimile terminal and voice processing markets. The fax market exploded from $821 million in 1987 to almost $4.0 billion by 1990. The fax has become an essential part of business communications, and the office without a fax is becoming an anomaly. New technologies that allow fax terminals to be hooked to personal computers, allow faxes to double as photocopiers and/or printers, and increase the speed of fax transmission continue to boost the market. Voice processing, principally voice messaging and voice response systems, is also being rapidly accepted in the business place as a means of increasing efficiency and customer satisfaction and of generating revenue. The market for voice processing equipment jumped from over $800 million in 1987 to more than $2.2 billion in 1990. Expectations are that the market will continue to grow rapidly in the near term as business customers' acceptance of "talking to a machine" continues to grow.

The traditional segments of the customer premises market--PBXs and key systems--have not fared as well. Due to intense competitive pressures, the value of the PBX market decreased somewhat from $3.1 billion in 1987 before stabilizing at $2.9 billion for 1988, 1989, and 1990. This lackluster performance is likely to improve slightly during the early 1990s, as customers that bought in the great buying spree of 1984 and 1985 begin to replace their systems and as ISDN standards are implemented and ISDN-compatible PBXs gain popularity. In the key system market, total sales increased marginally from $960 million in 1987 to $965 million in 1988. Toward the end of 1989, prices began to firm as a result of the AT&T dumping case, an important trade action filed by AT&T against Japanese, Taiwanese, and Korean producers. This stabilization of prices helped boost the market to $995 million in 1989 and just over $1.0 billion in 1990.

Other factors affecting the PBX and key marketplace include the revitalization of Centrex services by the telephone companies (a service that competes in functionality with PBXs) and the growth of the secondary market, *i.e.*, the market for used equipment. The secondary market has grown from practically nothing a few years ago to over $510 million by 1990.

The consumer telecommunications market, principally corded and cordless telephones and answering machines, continues to expand, increasing from $2.3 billion in 1987 to $3.2 billion in 1990. The most significant growth area occurred in the cordless telephone segment of the market, which increased from $355 million in 1987 to $515 million in 1990.

Network Equipment

The U.S. market for telecommunications network equipment consists of purchases by telephone companies and other companies for private networks. The total market for such equipment increased from $8.2 billion in 1987 to $9.6 billion in 1990. This growth is due, in part, to the increasing popularity of cellular telephone systems. Annual capital expenditures of cellular common carriers increased from $234 million in 1984 (the year cellular radiotelephone service was authorized by the FCC) to $526 million in 1987 and to $1.8 billion by 1990. In addition, telephone common carriers have been upgrading many of their central offices for implementation of ISDN trials.

The market for central office (CO) switches increased irregularly from $2.9 billion in 1984 to $5.5 billion in 1986 before decreasing slightly to $5.0 billion in 1990. As cellular telephone systems convert from analog to digital technology, which is likely to begin in the early 1990s, and as implementation of ISDN and other advanced services progresses, the market for CO switches will accelerate somewhat and is projected to amount to $8.1 billion by 1995. Digital CO switches increasingly used for wireline networks and under development for cellular systems have begun to compete successfully with PBXs in offering such advanced features as voice mail, speed calling, conferencing, call forwarding, call waiting, and CO-based local area networks (LANs).

Another important growth segment of the network equipment market is fiber optics, a relatively low cost, very high capacity medium. The market for fiber optics in the United States doubled from $410 million in 1984 to $883 million in 1986, and doubled again to $1.7 billion in 1988. By 1990, the market had reached $2.2 billion. The explosive growth in fiber optics has been due principally to purchases by long distance carriers. Most carriers have now replaced the majority of their network with fiber optics, so purchases by long distance carriers will no longer provide the impetus for such rapid growth in the market. Local exchange carriers have begun to lay fiber in the local loop, but principally to new businesses. Retrofitting to existing businesses will come slowly, but will provide some growth potential. For cost reasons, retrofitting fiber to the home is not likely to happen for decades. One of the most promising growth areas for fiber optics is in LANs. For a variety of reasons, fiber is increasingly the LAN medium of choice.

Telecommunications Services

The U.S. telecommunications network links telecommunications and computer equipment for voice, text, data, and video transmission. About 85 percent of the traffic on the domestic public network is voice; data accounts for roughly 10 percent, and video and other specialized services account for the remainder. About 495 billion calls are placed each year over the public network. On average, each person makes almost 2,000 calls a year, or nearly 5.5 calls per day. Businesses account for about 20 percent of long distance domestic telephone use; residential users account for some 71 percent, and government and specialized users make up the rest. There are more than 220 million telephones in use in the United States, with about 93 percent of all households having telephone service.

There are currently more than 121 million access lines in the United States--70 percent dedicated to residential use, 28 percent for business use, and the balance for specialized use.

The principal providers of telecommunications services are common carriers. This type of company is obliged to provide service to customers on a nondiscriminatory basis. Common carriers that provide basic service can be divided into two types--local exchange companies and interexchange companies.

For the most part, local exchange companies are comprised of two general groups--the 22 companies spun off by the 1984 divestiture of AT&T and grouped into seven regional holding companies, and independent telephone companies. The local telephone companies had total revenue from all sources of approximately $117 billion in 1989, up 11 percent over 1988.

Interexchange companies provide long distance services. The top three interexchange carriers which collectively account for over 90 percent of the long distance market are AT&T, MCI, and U.S. Sprint. The total market for long distance services amounted to almost $51 billion in 1989, a 13 percent increase over 1988.

Implementation of ISDN is one of the key potential growth factors for the telecommunications services marketplace. While ISDN trials were launched in 1988, general implementation on a commercial basis is just beginning. ISDN to the home will probably not occur before the turn of the century, and probably even later than that. For business users, ISDN will provide a great variety of features currently unavailable from the public network. ISDN will allow simultaneous transmission of voice, data, and video over a single transmission path. In addition, features traditionally available only with a sophisticated PBX will be available to all ISDN users.

Aside from the promise of new services with the implementation of ISDN, the traditional telecommunications services business is no longer limited to basic telephone and telegraph services. Due to the convergence of voice and data in both technology and market structure, the industry now provides such services as computerized data transmission, electronic mail, videoconferencing, videotext, database access, software-defined "virtual" networks, "800" service, "900" service, teleconferencing, facsimile, voice messaging and other voice processing, call forwarding, call screening, environment control, and remote control of security devices.

Table 1

Value of Selected U.S. Telecommunications
Equipment Markets, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR*
	Millions of Dollars						Percent
Private Branch Exchanges	2,843	3,086	3,105	3,050	2,928	2,875	.2
Central Office Switches	2,900	4,750	5,500	5,100	5,050	4,975	11.4
Key/Hybrid Telephone Systems	1,039	955	957	960	965	995	-1.0
Telephone Sets (all types)	1,200	1,585	1,685	1,750	1,825	1,875	9.3
Facsimile Equipment	175	164	260	821	1,825	2,887	75.0
Modems	1,100	1,266	1,500	1,650	1,840	2,025	13.0
Multiplexors (including T-1)	550	613	700	840	1,200	1,600	23.8
Local Area Network Equipment	300	450	700	800	1,025	1,450	37.0
Fiber Optic Equipment	410	500	883	1,011	1,650	1,990	37.1
Radio Communications Equipment (mobile radio systems and radio communications links)	3,500	3,750	3,970	4,250	5,000	5,110	7.9
Other Telecommunications Eqpt.	6,835	7,665	8,102	8,286	6,972	6,948	.3
Total Telecom Equioment	20,852	24,784	27,362	28,518	30,280	32,720	9.4

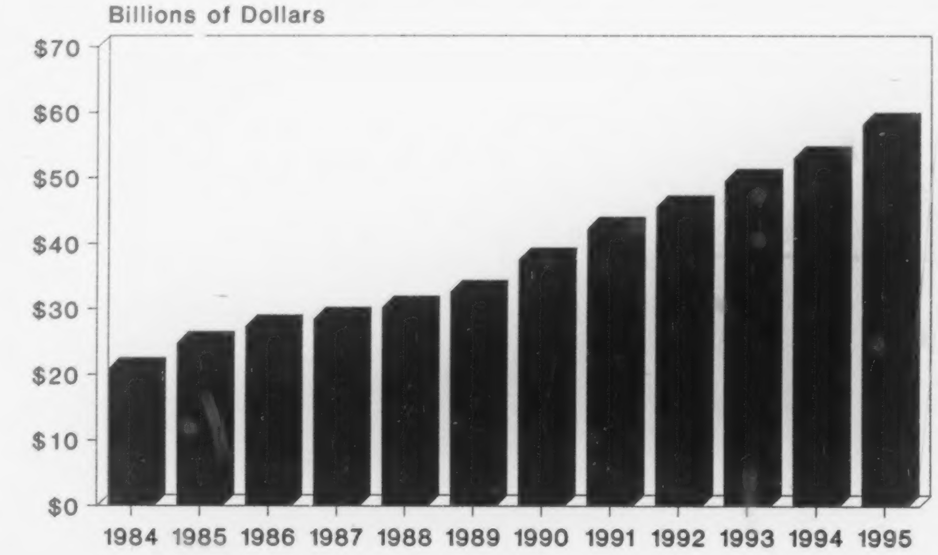
	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(e)	CAGR*
	Millions of Dollars						Percent
Private Branch Exchanges	2,850	2,900	3,100	3,250	3,285	3,400	3.6
Central Office Switches	4,960	5,009	6,025	7,050	8,126	8,650	11.8
Key/Hybrid Telephone Systems	1,050	1,100	1,125	1,175	1,250	1,275	4.0
Telephone Sets (all types)	1,890	1,975	2,100	2,250	2,375	2,863	8.7
Facsimile Equipment	3,992	4,796	5,010	5,361	5,723	6,476	10.2
Modems	2,450	2,785	2,850	2,875	2,850	2,625	1.4
Multiplexors (including T-1)	2,125	2,750	3,025	3,070	3,125	3,482	10.4
Local Area Network Equipment	2,020	2,210	2,251	2,375	2,550	2,685	6.0
Fiber Optic Equipment	2,540	2,950	3,520	4,300	4,950	5,810	18.0
Radio Communications Equipment (mobile radio systems and radio communications links)	5,775	6,977	7,450	8,326	9,125	10,320	12.3
Other Telecommunications Eqpt.	7,317	7,468	8,077	8,589	9,302	10,344	7.2
Total Telecom Equipment	36,969	41,420	44,533	48,621	52,661	57,930	9.3

(e) Estimated
* Compounded Annual Growth Rate
(p) Projection

Source: NATA Market Research Department

Figure 1

Value of the U.S. Telecommunications Equipment Market, 1984-95



Source: NATA Market Research Department

U.S. TELECOMMUNICATIONS EQUIPMENT MANUFACTURING INDUSTRY

U.S. TELECOMMUNICATIONS EQUIPMENT MANUFACTURING INDUSTRY

The U.S. telecommunications equipment manufacturing industry typically focuses on the production of high-end, high-technology products. Much of the manufacturing of consumer-oriented, relatively low-end products is conducted abroad and imported. As shown in Table 2, U.S. factory shipments of all types of telecommunications equipment increased from $19.7 billion in 1984 to $25.5 billion in 1985 and to $27.4 billion in 1989. Most segments show some positive growth, with the very notable exception of facsimile terminals. Despite an exploding market, U.S. manufacturers have virtually stopped fax production. The only area of the fax marketplace U.S. producers are addressing is the market for PC fax boards. These devices are board-level components that can be inserted in a personal computer to allow PC-to-fax communications. PC boards currently represent a relatively small part of the overall fax market.

CO switches represent the most significant product area for U.S. producers, accounting for 17 percent of total manufacturers' shipments in 1989. Other significant product areas in 1989 included data communications equipment (16 percent), mobile radio communications systems (11 percent), common carrier line equipment (10 percent), miscellaneous switching equipment (7 percent), PBXs (5 percent), and radio communications links (6 percent). Miscellaneous products and parts account for the balance.

The relative health of the industry can be analyzed by reviewing such information as inventories, capital expenditures, etc. (see Table 3 and Fig. 3). Some indicators point to a rather healthy industry. Year-end inventories decreased both in absolute terms, from $6.4 billion in 1988 to $6.3 billion in 1989, and as a share of production, from 25 percent to 23 percent respectively. Other positive factors include the decreasing cost of materials. As a percentage of shipments, the cost of materials has decreased from 41 percent in 1988 to 40 percent in 1989. In addition, as a share of the value of shipments, total wages have been rather stable for the past several years. These indicators point to a rather healthy industry. Moreover, the industry is operating at a higher productive capacity than either the computer industry or the average for all manufacturing establishments.

Other operating and financial ratios, however, suggest that the communications manufacturing industry, while healthy, is perhaps not as robust as the computer industry. For instance, expenditures on research and development as a percent of net sales in the telecommunications equipment industry averaged 6.6 percent compared to 12.0 percent for the computer industry. The current and quick ratios for communications equipment were 1.5 and 1.8 percent, respectively, compared to 1.6 and 1.4 percent, respectively, for the computer industry. Return on equity amounted to 7.6 percent, 8.6 percent, and 5.0 percent for the industry, computer industry, and all manufacturing industries, respectively.

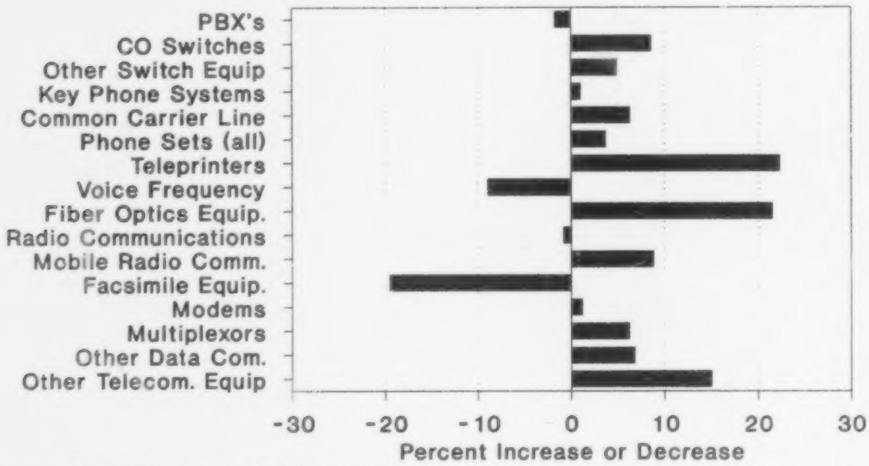
In general, the implications are that the communications equipment industry is becoming increasingly more efficient and profitable and that, at least by some measures, it is healthier than the U.S. manufacturing sector as a whole, although not as robust as certain specific industries such as the computer/office equipment industry. It is likely that the trend toward increasing efficiency will continue in the near future and that capital expenditures will rise as the industry prepares for the wide-spread implementation of ISDN and the age of digital communications.

Despite a generally positive scenario for the industry as a whole, it is clear that U.S. makers of certain products are not faring well financially. This is especially true for U.S. producers of commodity, consumer-oriented products. In general, the closer the product is to the mass market, the more difficult it is for U.S. producers to maintain profitability.

The trend in prices producers charge for their equipment for the first wholesale transaction varies by product (see Table 5 and Fig 4). Overall, for all telephone and telegraph equipment (not including radio equipment or fiber optic systems), prices increased 11 percent from 1985 to 1989. Prices of CO switches increased 8 percent from 1985 to 1987 before decreasing and, by 1989, amounted to just slightly above 1985 prices. Prices of telephone sets, the segment with the most price sensitive demand, decreased more than 11 percent between 1985 and 1989.

Prices for exports of U.S.-made telephone and telegraph products increased more than 9 percent between 1985 and 1989, while import prices increased irregularly by more than 8 percent during that time period. For radio and television communications equipment (including mobile communications systems, radio communications links, fiber optics and radio and television broadcast equipment), export prices increased a mere four percent, while import prices increased by 14 percent.

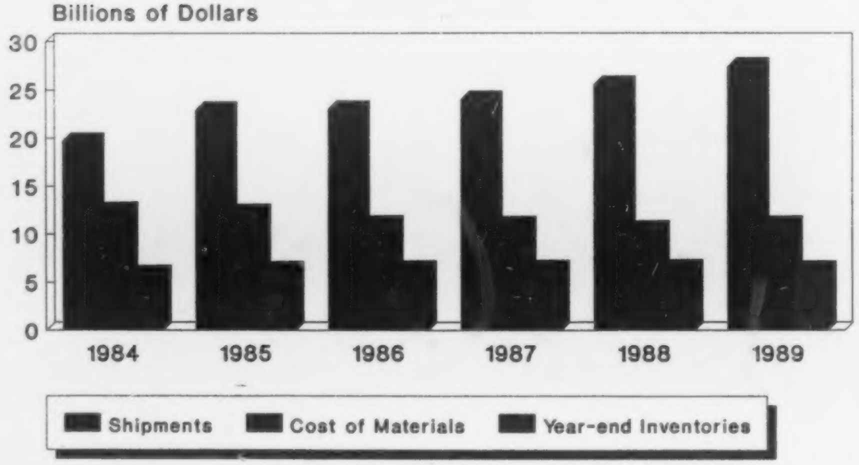
Annual Growth Rates of U.S. Manufacturers' Shipments of Selected Telecommunications Equipment, 1984-1989



Source: Based on statistics of the U.S. Department of Commerce

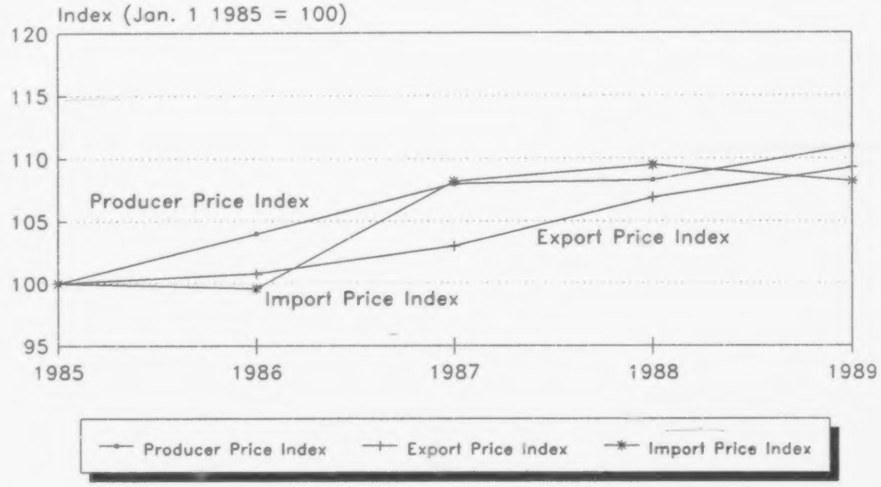
Figure 3

Manufacturers' Shipments, Material Costs, and Year-end Inventories of Telecommunications Equipment



Source: U.S. Department of Commerce

Figure 4



Comparison of Domestic, Import & Export Prices for Telephone & Telegraph Equipment, 1985–89

Source: Bureau of Labor Statistics

Table 2

Value of U.S. Manufacturers' Factory Shipments of Selected Telecommunications Equipment, 1984-89

Equipment	1984	1985	1986	1987	1938	1989	CAGR*
	- - - - - - - - - - Millions of Dollars						Percent
Private Branch Exchange	1,604	1,721	856	1,222	1,300	1,450	-2.0
Central Office Switches	2,857	4,333	4,472	4,442	4,500	4,650	10.2
Other Switching Equipment	1,410	1,661	1,852	1,816	1,850	1,865	5.8
Key Telephone Systems	895	880	876	882	878	950	1.2
Common Carrier Line Equipment	1,917	2,329	2,833	2,737	2,745	2,750	7.5
Telephone Sets (all types)	847	1,219	790	1,003	1,025	1,050	4.3
Teleprinters	663	474	361	325	175	150	-25.8
Voice Frequency Equipment	302	328	243	196	150	175	-10.3
Fiber Optics Equipment	254	529	637	701	755	800	-25.8
Radio Communications Link	1,678	1,953	1,887	1,765	1,543	1,600	-1.0
Mobile Radio Comm. Systems (including cellular radio systems)	1,818	1,782	2,139	2,567	2,772	2,890	9.7
Facsimile Equipment	100	64	49	38	23	28	-22.5
Data Communications Equipment:							
Modems	1,117	1,047	1,229	1,078	1,155	1,200	1.4
Multiplexors	1,407	1,644	1,750	1,801	1,892	2,000	7.3
Other Data Comm. Equipment	830	648	765	972	1,180	1,225	8.1
Other Telecommications Equipment	2,001	2,305	2,276	2,455	3,598	4,550	17.9
Total Telecom. Equipment	19,700	22,917	23,015	24,000	25,541	27,433	6.8

(r) Revised
(e) Estimated by NATA Market Research Department
* Compound Annual Growth Rate

Source: Based on Data of the U.S. Department of Commerce

Table 3

Miscellaneous Industry Information Related to the Production of Telecommunications Equipment

Item	1984	1985	1986	1987	1988	1989	CAGR* Percent
Shipments: $ millions	19,700	22,917	23,015	24,000	25,541	27,433	6.8
Year-end Inventories: $ millions	5,876	6,250	6,336	6,375	6,410	6,300	1.4
New Capital Expenditurers: $ millions	1,350	1,246	1,123	1,175	1,238	1,450	1.4
Cost of Materials: $ millions	12,500	12,301	11,081	11,000	10,500	11,000	-2.6
Value Added by Manufacture: $ millions	9,999	14,469	18,396	21,040	23,760	24,000	19.1
Total Employment: 1,000s	234	239	223	213	212	250	1.3
Production Workers: 1,000s	131	128	110	106	106	110	-3.4
Average hourly Wage: $	12.09	12.08	11.94	12.19	12.25	13.00	1.5
Value Added per Employee: $ thousands	64	62	66	68	66	68	1.2

(r) Revised
(e) Estimated by the NATA Market Research Dept.
* Compound Annual Growth Rate

Source: Based on Data of the U.S. Department of Commerce.

Table 4

Selected Operating and Financial Ratios for the Communications Equipment Producing Industry; Computer and Other Office; and All Manufacturing for 1987

Item	Communications Equipment	Computers et al.	All Manufacturing
Capacity Utliization (percent of total capacity)	85.0	74.0	69.5
R & D as a percent of Net Sales	6.6	12.0	N/A
Advertising as a percent of Net Sales	1.5	1.4	1.6
Current Ratio (Current Assets to Current Liabilities)	1.8	1.8	1.4
Quick Ratio (Liquid Assets to Current Liabilities)	0.9	1.1	0.9
Net Assets to Working Capital	3.7	2.7	N/A
Asset Turnover	0.7	0.6	1.0
Liabilities to Net Worth	2.4	1.5	1.4
Debt Ratio (Total Debt to Total Assets)	70.2	60.6	58.0
Return on Assets	4.9	10.7	7.5
Return on Equity	7.6	8.6	5.0
Retained Earnings to Net Income	45.3	36.2	25.0

Source: Almanac of Business and Industrial Financial Ratios: 1988 edition; Prentice Hall.

Table 5

Various Price Indices for Certain Telecommunications Equipment, 1985-1989

Index	1985	1986	1987	1988	1989
			Percent		
Producer Price Index:					
Telephone and Telegraph Apparatus	100.0	104.0	108.0	108.3	111.0
Central Office Switches	100.0	101.6	108.3	105.7	101.3
Private Branch Exchanges (PBX)	100.0	99.7	96.7	96.1	96.4
Less than 400 Line PBX's	100.0	99.2	93.7	94.3	95.8
400 Lines and over PBX's	100.0	100.0	99.5	93.6	N/A
Data Communications Equipment	100.0	99.0	98.5	100.7	101.1
Telephone Sets	100.0	93.2	90.5	92.3	89.8
Key Sets	100.0	100.0	97.0	103.2	103.2
Other Sets	100.0	99.0	84.0	78.2	76.0
Export Price Index for Telephone and Telegraph Equipment	100.0	100.8	103.0	106.9	109.3
Export Price Index for Radio and Television Communications Equipment	100.0	99.1	99.4	100.8	103.8
Import Price Index for Telephone and Telegraph Equipment	100.0	99.6	108.2	109.5	108.2
Import Price Index for Radio and Television Communications Equipment	100.0	110.1	113.1	115.2	114.0

Source: Bureau of Labor Statistics

INTERNATIONAL DEVELOPMENTS

INTERNATIONAL DEVELOPMENTS

The U.S. telecommunications marketplace can no longer be evaluated in a vacuum. It is but one piece of a dynamic global collage where industry participants span national borders and multilateral and bilateral trading blocs are creating huge new markets and tremendous opportunities for growth. Developments in U.S. foreign trade policy as well as the economic integration of the European Community, economic and political changes in Eastern Europe and the Soviet Union, and a general international trend towards stimulating competition in telecommunications markets have profound implications for industry players.

U.S. Foreign Trade Activities

Overview

International trade in merchandise has become very important to the health of the U.S. economy over the past decade. Not very long ago, trade turnover (imports plus exports) accounted for less than five percent of the gross national product (GNP). In 1989, trade turnover, a measure of total trade activity, accounted for 14 percent of GNP. As international trade--both imports and exports--becomes more critical to the U.S. economy, the problems of managing our trading relationships become more difficult. In a nation such as the United States, built on free enterprise in goods and services, the concept of hands-on management of trade becomes a thorny issue.

Because the United States is generally oriented toward free trade and has relatively low barriers to imports, foreign producers are able to sell successfully here. The reciprocal, however, is often not true, and U.S. producers are frequently not given the same market opportunities abroad. The U.S. suffers trade imbalances that are caused not by economic factors such as comparative advantages in raw materials, etc., but by parochial political concerns. These imbalances are behind much of the current political pressure on the U.S. government to take a more active role in managing trade relations.

International trade in telecommunications is one business where political concerns can outweigh economic concerns. For most types of telecommunications products, especially those used by consumers and businesses, the United States maintains a relatively open and competitive marketplace, and imported products have done well. In many foreign countries, however, U.S. producers have found restrictive barriers to trade. As a result, the U.S. trade balance in telecommunications equipment worsened from minus $1.2 billion in 1984 to minus $2.6 billion in 1988 before improving to minus $1.9 billion in 1989 (see Figure 5). This improvement is the result of increased efforts of U.S. manufacturers to tap emerging markets abroad, coupled with aggressive U.S. negotiators pressing for increased U.S. market access abroad. One of the continuing bright spots remains the trade surplus with the European Community, which increased from $326 million in 1987 to $781 million in 1989.

Clearly, the trend in U.S. trade patterns reflects the types of products U.S. producers manufacture, the openness of foreign markets, the openness of the U.S. market, and the international economic climate. U.S. producers manufacture mainly high-end, high-technology products. With those products, U.S. producers have been relatively successful both here and abroad. Import penetration in the U.S. marketplace is principally in low-end, consumer-oriented products. For the most part, this segment has been abandoned by U.S. producers as relatively unprofitable.

International trade in telecommunications equipment depends on a variety of factors. Exchange rates, customs duties, historical trading relationships, and general economic conditions are significant determinants of international trade. Until recently, changes in the exchange rate, for instance, have tended to stimulate U.S. exports. Since 1984, the U.S. dollar has decreased by almost 40 percent in value against a composite, trade-weighted, average of the currencies of our major trading partners. The dollar has recently begun to edge up vis-a-vis the currencies of our major trading partners; nonetheless, U.S. exports continue to hold a relatively good price position abroad.

Despite these factors, one of the most important determinants of trade in telecommunications is government intervention. Most countries around the world have government-owned telecommunications authorities that provide telecommunications services to the public. These companies, frequently called PTTs (Post, Telephone, and Telegraph), are the largest, and sometimes the only, major purchaser of telecommunications equipment within their countries. PTTs usually favor domestic suppliers and foreclose international competition. Nontariff barriers erected by the government, such as stringent certifications procedures, import licenses, subsidies, etc., limit the amount of foreign participation in the local telecommunications equipment market. The situation is beginning to change, however, as PTTs start to liberalize their purchasing decisions.

Managing Telecommunications Trade

Because the U.S. economy relies heavily on free-market mechanisms, the management of trade by the U.S. government does not represent a coherent industrial policy. It is, instead, a system of *ad hoc* reactions to specific problems. The result is that trade management is very fragmented and cumbersome and involves competing interests. For telecommunications, there are 17 Congressional subcommittees responsible for creating a framework for trade policy within which ten executive agencies operate.

The executive agencies responsible for most of the governmental activities regarding trade in telecommunications include the Office of the U.S. Trade Representative (USTR); the Departments of Commerce, State, Treasury, Defense, and Justice; the International Trade Commission (ITC), the Small Business Administration, the Export-Import Bank, and the International Development and Cooperation Agency. Together, these agencies manage the day-to-day responsibilities of ensuring that U.S. trade policy stimulates the competitiveness of U.S. industries through the management of trading relationships that are not always based on reciprocal market opportunities.

Several recent activities highlight the complex nature of U.S. telecommunications trade policy. The AT&T dumping case provides insight into how the Department of Commerce (Commerce) and ITC conduct an antidumping investigation. In essence, the procedure, which took more than a year to complete, required Commerce and ITC to conduct two investigations each to determine whether or not to impose dumping duties on imports of small business telephone systems from Japan, Korea, and Taiwan. The case was completed in early 1990 and represented a victory for AT&T and Comdial (copetitioner in the case). At that time, all imports of small business telephone systems from Japan and Korea and certain products from Taiwan became subject to additional dumping duties. For Japanese- and certain Taiwanese-made products the duties are very high; for imports from Korea the margins are fairly low.

The impact of this decision has been a redistribution of market share among the major players. In the short term, prices for small business phone systems have stabilized and even inched up a bit, perhaps by as much as five to ten percent. That increase will be short lived, however, and by mid-1991 prices will begin to fall. The main losers are the small Japanese producers and their U.S. distributors that will be subject to high dumping duties and do not have the resources to shift production to the United States or to a third country.

Other significant developments include the recent enactment of the Omnibus Trade and Competitiveness Act of 1988. This act has targeted telecommunications as a strategic industry and has imposed various measures to ensure that U.S. producers are afforded the maximum import relief in the U.S. market within the bounds of a relatively free trade environment. In addition, the Act attempts to ensure to the extent possible, greater market access abroad for the U.S. industry. As part of this effort, the USTR is required to review existing trade agreements, including a 1986 agreement with Japan designed to open access to the Japanese market to U.S. companies. On May 8, 1989, the USTR found that the Japanese had not lived up to the agreement and threatened punitive actions. At the eleventh hour, the Japanese sent a negotiator and the issue was resolved.

In addition, on January 1, 1989, the United States and Canada began implementation of an historic free trade agreement crafted to eliminate virtually all tariff and nontariff barriers to trade between the two countries within ten years. In telecommunications the timetable will be accelerated, with most trade barriers to be eliminated within five years. This agreement will provide significant advantages to producers of equipment and services on both sides of the border, since there already exist common telecommunications network standards, and virtually no adaptations are required.

Other important developments include the United States' participation in various international forums that have as their goals the global harmonization of telecommunications standards, trade policy coordination with the aim of reduced trade barriers, cooperation in international financial and economic policy matters, and a general trend toward increased economic and political interdependence. These forums include the General Agreement on Tariffs and Trade (GATT), the International Telecommunications Union (ITU), the Organization for Economic Cooperation and Development (OECD), and other similar organizations.

U.S. trade policy is based on the notion of free access to U.S. markets in return for access to markets abroad. Despite occasional setbacks, the global trading environment is gradually becoming more fair and open as governments around the world realize that economic gains can be achieved through freer competition. This trend bodes well for U.S. producers, since they already operate in a highly competitive domestic environment and can translate that experience to markets abroad. With the right mix of products, management insight, and strategic goals, U.S. companies should be able to capitalize on the emerging global marketplace and make significant inroads into areas once considered impenetrable.

Implications of U.S. Policies

International trade in telecommunications is becoming a top issue in government trade regulation policy forums and is being debated at the highest levels of government. There are two seemingly divergent trends in government attitudes towards the management of trade. Trade idealists want no management of trade whatsoever, while more pessimistic telecommunications trade analysts argue that the U.S. has already made tremendous unilateral concessions with the divestiture of AT&T, and that trade needs to be heavily managed to maintain for U.S. producers the portions of the market in which they can still compete for U.S. producers. There are evidences of both trends, but the synthesized policy that has developed basically represents a pragmatist's approach to trade: the management of trade to the extent necessary to achieve the maximum economic benefits possible to all parties given that the international trading environment is frequently ruled by political rather than economic concerns. In essence, U.S. policy has evolved based on trying to reduce U.S. trade imbalances caused by an inequitable trade environment.

Several of our trading partners are becoming disillusioned by our seeming ambivalence with respect to the implementation of telecommunications trade policy. Two cases in point are Japan and the European Community (EC).

The U.S. has made Japan the object of virtually every conceivable trade action. As a result, despite the fact the United States is by far their biggest customer, the Japanese are becoming as frustrated with the trade relationship as we are. In addition, the political climate in Japan has begun to change, suggesting a more protectionist and less conciliatory trade environment. It seems likely, therefore, that the trade relationship between Japan and the U.S. will not improve in the near term.

An out-and-out trade war is not likely, however. Each country has too much economic interest vested in the other. We are dependent on the Japanese for the financing of our national debt. Moreover, we depend on them for certain strategic products no longer manufactured in the United States, especially electronic components. The Japanese depend on us as the biggest market for their products and the safest and most profitable haven for their excess cash.

The EC is undergoing one of the most significant economic upheavals in its history--integration into a single market (see following section). In the best of times, the U.S./EC trade relationship has been less than harmonious. Most of the transatlantic arguments have been over agriculture, but the EC countries have shown that they are not adverse to trade friction over a variety of products. The United States has recently named the EC as a priority body for negotiations in telecommunications trade issues. The Europeans have indicated that they view our reasons for targeting them are groundless. With the integration of the EC economies, the Europeans will represent the largest single market in the world and have even less incentive to defer to us. Still, the overall relationship will probably remain relatively smooth since there are too many vested economic and political interests to allow the relationship to become too stormy.

Despite the possible risks of this pragmatic approach to trade management, the global trading environment is probably on an upswing in terms of cooperation and barrier reductions. The three most hopeful signs are the U.S./Canada Free Trade Agreement; the removal of the barriers between the EC countries (unthought of, even as a remote possibility, not long ago); and the Uruguay Round of trade negotiations (a new round of multilateral trade negotiations, currently underway under the auspices of the GATT) due to be completed by year-end 1990. (In December 1990, the GATT talks broke down, but they may be revived in early 1991.) These signs point to a global economy that is becoming more and more intertwined.

1992 Economic Integration of the European Community

The marketplace for telecommunications equipment in the EC is in a state of profound change. The blueprint of that change, the Green Paper issued by the Commission of the EC in June 1987, envisions a very sophisticated, highly integrated, pan-EC telecommunications marketplace as a cornerstone of EC 1992, the historic plan to integrate virtually all aspects of EC economic activity.

The Green Paper proposes to eliminate barriers to intra-EC telecommunications services and telecommunications equipment sales. In addition, the Green Paper explicitly calls for the conversion of the telecommunications marketplace to a market driven by competitive forces. Achieving these aims would represent a reversal of traditional policies, under which EC members have developed their own telecommunications networks with little regard to coordination across national borders. With EC 1992, all that will change.

It is clear that as the world becomes a smaller place in which to do business, international competitiveness will depend on the ability to penetrate global markets. Businesses will rely increasingly on sophisticated integrated telecommunications networks to track supplies from foreign sources, communicate with far flung branch offices, court and service customers across the globe, and coordinate worldwide marketing.

To meet that challenge, the EC is adopting the goals of the Green Paper to place the EC telecommunications infrastructure at the forefront of technology and strengthen the global competitiveness of EC telecommunications suppliers. To achieve this goal, however, many obstacles must be overcome, including ingrained nationalism, divergent cultures, language barriers, and bitter feelings from past military struggles.

In telecommunications, the situation is about as difficult as it could be. The indigenous telecommunications service providers, usually PTTs, have traditionally guarded their fiefdoms by allowing no competition in services and, through coddling domestic suppliers, little competition in equipment. Their mandate has typically transcended providing cost-effective telephone services to reach into the realm of politics and social ideologies.

All this has produced a fragmented marketplace, incompatible networks, great inequalities in infrastructures, disparities in service pricing, and inefficient domestic equipment producers and service providers. In essence, the EC integration of European telecommunications is scattered with land mines.

That is not to say that there is no hope. There are glimmers of positive achievements. Newly introduced pan-European digital cellular and paging appear to be on the brink of success. The EC seems to be fairly far along in the implementation of pan-EC ISDN as well. Where new technology can be adopted *en masse*, the Europeans seem to collaborate well. Patching together existing data and voice networks is where many of the problems lie. Slowly but surely, even these problems will be resolved.

Due to the many technical, economic, legal, and political challenges, it is clear that full integration of European telecommunications will not occur until after 1992.

When integration is achieved, however, the results will be well worth the struggle. In 1992, the integrated EC telecom equipment marketplace is expected to amount to $33.2 billion and to become the second largest market in the world, accounting for more than 25 percent of worldwide sales. By 1995, with rapid growth expected, the size of this market will reach some $41.0 billion and may surpass the U.S. market as the largest in the world.

This explosive demand for equipment and services is being sparked by the reunification of Germany, a mass migration of foreign companies to European soil to access the world's largest marketplace, and Spain's 1992 hosting of both the Olympics and the World Trade Fair. Moreover, European companies are preparing for the onslaught of foreigners and are sharpening their own competitiveness for a unified EC marketplace, sometimes with the help of outsiders. For example, GE Information Services manages a data network for Italian clothing retailer Benetton. The network links offices of 35 regional agents to 12 manufacturing plants in Italy, France, Spain, and Britain.

The fastest growing markets will be in nations with the most antiquated networks. Accordingly, Ireland, Portugal, Spain, and Greece will experience some of the most rapid growth rates through 1992 and beyond.

In terms of product areas, the largest markets will be for CO switches at $6.8 billion by 1992 and transmission equipment at $5.6 billion. The transmission equipment market will experience the most rapid growth, rising to $8.0 billion by 1995. Other important equipment markets will include mobile communications at $4.4 billion by 1992, cables at $4.1 billion, data communications equipment at $2.9 billion, fax systems at $2.6, and PBXs at $2.4 billion.

The major players in the European marketplace will be those who work aggressively to support the market long term. Most likely, indigenous suppliers such as Siemens, Alcatel, Ericsson, GEC, Philips, and Italtel will continue to dominate, but there will remain plenty of room for others. The most promising prospects for non-European suppliers will be in the business market. Telecommunications users, including increasing numbers of U.S.-based multinationals accustomed to sophisticated telecommunications capabilities in the United States, are generally dissatisfied with PTT offerings and are looking for more sophisticated products and services at competitive prices.

Whether or not an increase in external barriers will accompany a reduction in internal barriers is definitely open to debate, and a lot of it. The U.S. government has been aggressive in trying to ensure that the much prophesied Fortress Europe will not become a reality. But signals are mixed on how successful these efforts have been, and it is clear that much remains to be done to ensure that there is no increase in external protectionist measures at the same time that internal barriers are dropped.

In discussions over the openness of the EC market to foreign firms, the Europeans have expressed concern over a number of U.S. initiatives they claim may inhibit EC exports to the U.S. market. Some of these include the movement on some fronts to modify the terms of the AT&T consent decree to allow the Regional Bell Operating Companies to manufacture telecommunications equipment. The EC has also expressed concern over some of the provisions of the 1988 Omnibus Trade Act. While this is clearly a strategy to strengthen their negotiating position, the EC claims it does not want to throw open the doors to the EC market if the doors to U.S. market are being closed.

Regardless of how these discussions are concluded, and irrespective of official policies, there will continue to be an ingrained European bias toward buying a product made in Europe or, at a minimum, buying from a company with extensive investment in Europe, especially on the part of public agencies. This leads many experts to recommend that companies interested in exploiting the rich opportunities that will develop to make as much of a commitment to Europe as possible. This might include direct foreign investment, joint venturing, or licensing agreements.

Nevertheless, a new order is clearly emerging in Europe. Despite monumental challenges, the EC understands that a common, sophisticated telecommunications infrastructure is essential to overall economic integration and growth. Integration will happen, if not by 1992, then perhaps by 1995. Whenever and however it occurs, it is going to be a marketplace that cannot be ignored.

Implications of Political Changes in Eastern Europe

The years 1989 and 1990 have witnessed a metamorphosis in Eastern Europe. In virtually every country, the traditional Communist government has been rejected and a movement has begun toward democratic and market-oriented reform. This will have profound implications on

East-West relations within Europe. Once subject to extreme restrictions on trade of high technology products by most western nations, Eastern Europe is becoming much less of a security threat. As a result, the multinational Coordinating Committee (COCOM) which establishes export controls to East Block countries has significantly relaxed restrictions in recent months. This will lead to new economic ties between the trading blocs.

Political ties will also be reformed, as demonstrated by the historic reuniting of Germany. In virtually every respect, the developments of Eastern Europe bode extremely well for east-west relations. The EC has called for several initiatives to improve relations between Eastern and Western Europe. Given the pace of change, it is not inconceivable that within a short time some of the most progressive Eastern European countries might apply for EC membership.

With telecommunications infrastructure such an important part of economic development, East European countries are actively seeking western technology. This has stimulated many western companies to begin aggressively evaluating opportunities in Eastern Europe.

There is every reason to look covetously at the Eastern European telecommunications market. With antiquated telecommunications networks, East European countries, including the Soviet Union, may spend up to $150 billion over the next decade to upgrade their networks. Taken together, these countries may eventually represent 20 percent of the world market for telecommunications equipment. Despite the initial attraction, the Eastern European market is complicated by nonconvertible currencies, lack of funds, lingering trade restrictions, and the East European predisposition to barter. Telecommunications suppliers interested in that market may have to be willing to swap telecommunications equipment for plywood, vodka, or even livestock.

In addition, the Eastern European countries are hardly homogeneous in political, cultural, and economic characteristics, and their telecommunications infrastructures differ markedly. Czechoslovakia is considered to have the best telephone network of the Eastern Bloc, despite a relatively low penetration rate of 12.5 phones per 100 inhabitants. Hungary has a poorer phone system, but is further along in economic liberalization. Poland has an even less sophisticated telephone system, but is aggressively seeking economic ties with the West. Bulgaria has the highest penetration rate in the East Bloc, with about 18 phones for every 100 inhabitants, but has moved very slowly on economic and political reforms. The Soviet Union has the third largest telephone system in the world with 27 million access lines, but a very low penetration rate of 11.3 phones per 100 inhabitants.

Despite the pitfalls, companies should evaluate the opportunities that do exist. A company with an aggressive, successful strategy in the EC stands a good chance of breaking into the East European markets as the economies of Eastern and Western Europe become more intertwined. This is especially true with telecommunications, where technical standards and certification policies can be strong impediments to trade. East European countries will undoubtedly be invited to join the European Telecommunications Standards Institute (ETSI) and other European standards bodies, thereby greatly enhancing technical compatibility in Europe as a whole.

Other International Trends

A number of other recent international developments promise to have dramatic implications for the worldwide telecommunications marketplace. Among these is the movement abroad of the Regional Bell Operating Companies (RBOCs), which are flexing their financial muscle in pursuit of diversification strategies. Feeding the RBOC hunger for overseas properties is the accelerating trend of foreign governments selling off, *i.e.*, privatizing their telephone systems. Privatization is occurring in different countries for different reasons, but in general the predominent reasons are to infuse the government with cash (especially true in developing countries) and to stimulate competition in the telecommunications marketplace in order to foster a more sophisticated telecommunications infrastructure--a key ingredient in economic growth.

Feeling somewhat hamstrung domestically, where regulations limit their ability to exploit their considerable economic power fully, the RBOCs have turned their attention abroad. All seven RBOCs have established subsidiaries to explore international ventures. The most agressive RBOC to date has been PacTel, whose foreign ventures have been estimated at $1.5 billion. Among its investments, PacTel has a 26 percent stake in a consortium to develop a second cellular network in Germany, a 20 percent stake in Microtel Communications to build a nationwide personal communications network in Great Britain, a franchise to build a cable TV network in Britain that could ultimately reach 830,000 homes, and a 10 percent interest in a trans-Pacific fiber-optic cable consortium.

Another aggressive RBOC, U S West, has foreign investments worth slightly over $1.0 billion. With partners, U S West holds cable TV franchises in Hong Kong, Britain, and France which represent a potential six million subscribers. U S West also has a 30 percent equity interest in Unitel, a consortium to develop a personal communications network in the U.K. The company also owns 49 percent of a cellular project in Hungary, and is co-leader of a consortium which is trying to build a fiber optic backbone through the Soviet Union. (The U.S. Department of Commerce has ruled that this project violates COCOM regulations, but U.S. West is appealing.)

BellSouth has also been active. To date, its foreign ventures are worth some $550 million. The company has cellular interests in Argentina, Uruguay, France, Britain, Switzerland, and Mexico, paging interests in Australia, Britain, and Switzerland, and cable TV interests in France. Other BellSouth foreign ventures include software and network modernization consulting and equipment distribution.

NYNEX foreign operations are worth some $330 million. They include a 50 percent interest in the telephone system of Gibraltar, cable TV interests in Britain, and software and telecommunications consulting activities around the world.

Until recently, Bell Atlantic's foreign activities were fairly minimal, amounting to some $120 million. However, it has just stepped up its international activities and, along with Ameritech, has acquired a 90 percent equity interest in New Zealand's telephone company. Bell Atlantic also actively sought to purchase equity interest in half of Argentina's telephone network. At this writing, it appears that Bell Atlantic's bid ultimately floundered when its partner, Manufacturers Hanover Corporation failed to provide the funding.

Southwestern Bell has pursued a modest policy abroad and has made foreign investments worth about $100 million to date, principally in cable TV interests in Britain and Israel. The company has also been active in overseas equipment sales and directory publishing.

Ameritech has been the least active of the RBOCs and the last to organize a subsidiary to concentrate on foreign opportunities. To date, its international investments are worth about $20 million, chiefly in voice messaging service bureaus in Western Europe and Japan. Ameritech appears poised to become more aggressive, as witnessed by its recent joint venture to acquire majority interest in New Zealand's telephone system with partner Bell Atlantic.

Other opportunities are bound to pique the interests of the RBOCs as some 27 countries around the world look to complete or partially privitize their telecommunications networks. Estimates are that the total investment value of these networks exceeds $145 billion. In Central and South America, Argentina, Mexico, Puerto Rico, Venezuela, Columbia, Brazil, and Paraguay all plan to sell at least partial interest in their telephone networks by 1994. In Western Europe, countries actively considering privatization include Portugal, Sweden, Ireland, the Netherlands, Denmark, Belgium, and Germany. In Eastern Europe, they include Hungary, Czechoslovakia, and Poland. In the Middle East, Israel, Saudi Arabia, and Turkey plan to privatize their networks. Elsewhere, South Africa, Kenya, Nigeria, Malaysia, Singapore, and South Korea have all announced that some form of privatization will occur within the next few years.

These countries have witnessed the privatization and deregulatory trends of the United States, Britain, Japan, and, most recently, New Zealand and have concluded that private investment in network operators can stimulate investment in the nation's telecommunications infrastructure while at the same time bring in much needed revenue to the government.

Figure 5

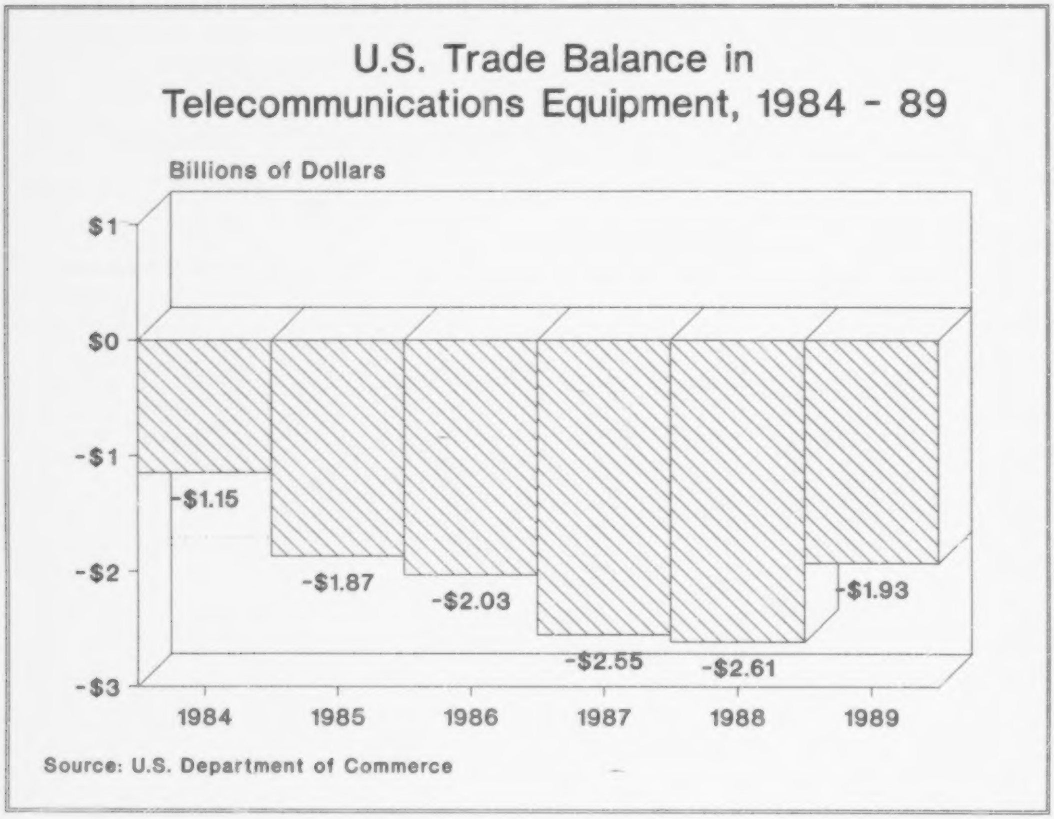

U.S. Trade Balance in Telecommunications Equipment, 1984 - 89
Billions of Dollars
$1
$0
-$1
-$2
-$3
-$1.15
-$1.87
-$2.03
-$2.55
-$2.61
-$1.93
1984
1985
1986
1987
1988
1989
Source: U.S. Department of Commerce

Table 6

U.S. Imports of Telecommunications Equipment, 1984-1988

Country	1984	1985	1986	1987	1988	1989
	Thousands of Dollars					
European Community:						
Belgium and Luxembourg	3,694	55	75	691	4,365	3,579
Denmark	5,923	4,23	3,26	2,309	4,047	5,257
France	48,502	94,490	41,181	73,549	130,556	109,667
Germany, West	34,352	49,772	44,891	49,761	73,260	103,236
Greece	1,225	792	1,741	1,178	1,671	2,598
Ireland	2,253	4,70	7,922	7,786	7,570	9,924
Italy	6,054	21,641	17,572	42,938	43,280	23,096
Netherlands	6,178	18,362	14,137	6,793	37,649	20,765
Portugal	3	25	20	189	94	170
Spain	3,987	14,516	14,367	2,417	1,340	7,310
United Kingdom	33,425	46,641	64,774	55,050	66,482	98,698
Total EC	145,596	255,728	210,617	242,662	370,315	384,300
East Asia						
Hong Kong	266,990	197,651	307,026	342,966	471,307	403,595
Japan	1,625,421	2,008,603	2,051,689	2,388,546	2,484,012	2,672,112
Korea, South	162,284	233,553	337,032	512,019	515,578	482,877
Singapore	142,121	207,579	260,861	355,364	500,648	480,319
Taiwan	373,442	458,127	586,783	721,127	698,288	612,376
Total East Asia	2,570,258	3,105,512	3,543,393	4,320,022	4,669,833	4,651,279
Canada	412,420	549,711	483,193	453,317	616,517	654,960
Mexico	108,758	196,634	209,484	238,884	259,626	275,030
Sweden	93,796	66,958	82,482	74,630	65,360	92,412
All Other	141,191	183,004	209,751	284,873	467,761	958,066
World	3,472,019	4,357,547	4,738,921	5,614,387	6,449,411	7,016,047

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note: Columns may not add due to rounding.

Table 7

U.S. Exports of Telecommunications Equipment, 1984-89

Country	1984	1985	1986	1987	1988	1989
	Thousands of Dollars					
European Community:						
Belgium and Luxembourg	13,423	20,020	27,670	20,699	38,567	38,210
Denmark	8,273	11,779	4,989	7,243	8,603	9,012
France	41,750	44,075	38,472	42,678	60,297	70,197
Germany, West	94,224	102,228	108,821	103,587	128,415	137,805
Greece	3,893	3,745	4,284	9,125	23,113	27,974
Ireland	18,479	8,181	8,797	8,315	10,074	2,397
Italy	34,090	36,120	35,976	44,850	71,202	103,395
Netherlands	30,038	71,267	83,626	79,051	90,691	90,305
Portugal	2,589	1,899	5,248	6,394	10,807	15,766
Spain	19,890	30,778	21,286	21,841	32,946	62,707
United Kingdom	150,914	179,347	191,245	225,381	313,099	627,175
Total EC	417,564	509,438	530,413	569,166	787,814	1,184,943
East Asia						
Hong Kong	44,478	39,560	49,291	58,761	92,927	120,600
Japan	74,283	106,185	138,655	175,485	263,151	528,120
Korea, South	141,318	132,989	103,707	68,321	151,906	183,077
Singapore	38,062	32,573	36,127	65,335	87,355	89,043
Taiwan	70,831	84,926	101,191	173,754	188,218	224,165
Total East Asia	368,973	396,233	428,972	541,656	783,557	1,145,005
Canada	256,858	246,547	250,790	331,740	431,911	522,426
Mexico	310,558	313,978	373,829	415,167	579,898	571,876
Brazil	85,380	109,769	211,853	286,420	345,369	276,910
All Other	881,507	915,281	912,493	920,452	912,484	1,379,439
World	2,320,839	2,491,245	2,708,351	3,064,600	3,841,033	5,080,599

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note: Columns may not add due to rounding.

TELECOMMUNICATIONS SERVICES OVERVIEW

TELECOMMUNICATIONS SERVICES OVERVIEW

The market for telecommunications services encompasses a wide variety of services, from simple "dial tone" to on-line data base access, packet switching, videoconferencing, and private networks. Telecommunications services are provided by local exchange carriers, interexchange carriers, and specialized carriers such as information service providers.

The total market for telecommunications services in 1989 amounted to about $128 billion (see Fig. 6). Of that, the local exchange portion (including intraLATA toll) amounted to $56 billion, long distance services amounted to $51 billion, information services such as on-line data bases amounted to $10 billion, special data communication services such as private packet switching services amounted to $6 billion, cellular services amounted to $3 billion, and voice messaging/processing and other call processing services amounted to $1 billion. By 1995, the telecommunications services market is expected to reach $175 billion. Much of this growth is likely to occur in the long distance segment (especially 800 and 900 services), as well as the rapidly expanding cellular, voice messaging, and audiotext segments. The market for data communications services will also experience strong growth in the near term but, as ISDN becomes widespread, the demand for data specific communications services will moderate.

The U.S. telecommunications network links telephonic and computer equipment for voice, text, data, and video transmission. About 85 percent of traffic on the public network consists of voice telephone communications; data traffic accounts for about 10 percent; and video and other specialized transmission account for the balance of domestic telecommunications. About 495 billion telephone calls were placed over the U.S. public network in 1989, of which almost 90 percent were local. On average, each person makes about 2,000 calls a year, or almost 5.5 per day. Business customers account for about 20 percent of long distance domestic telephone use, residential users account for 71 percent, and government and specialized users make up the balance. More than 63 percent of all calls are made during regular business hours. Nearly 94 percent of all households in the United States have telephone service.

Telecommunications service infrastructure investment currently accounts for more than 10 percent of gross fixed capital formation in both the United States and Western Europe. This suggests the tremendous importance the telecommunications network plays in activities of business and residential consumers.

According to a study conducted by *Networking Management* magazine, which gathered information from some 2,100 companies with over 50 employees, the average telecommunications budget in 1990 amounted to $15.5 million, or eight percent above the 1988 average budget of $14.4 million. On average, 55 percent of this is budgeted for voice telecommunications and 45 percent for data communications.

In terms of an industry breakdown, transportation companies budgeted the most for 1990--$57.3 million. Federal government agencies budgeted $37.7 million; state and local governments averaged $32.4 million; companies that provide business services averaged $171 million; retail establishments averaged $14.3 million; and insurance companies $11.2 million. Other industries surveyed include manufacturing, education, health care, and agriculture/mining/construction.

On average, 33 percent of telecom budgets was spent on line charges, 20 percent on salaries, 15 percent on equipment, 11 percent on lease payments, 9 percent on maintenance, and the balance on training, overhead, and other miscellaneous costs. In terms of the product/service offerings large business users will be expanding, 86 percent anticipate a significant increase in digital private lines, 85 percent expect to increase their expenditures on data communications networks, and 76 percent will increase long distance usage. Other areas of expansion include increased expenditures for fax equipment, cellular, voice messaging, and PBXs.

According to an International Communications Association study of companies that spend at least $1 million per year on telecommunications, on average large business telecommunications users spent 0.6 percent of their annual revenues on telecommunications, representing 0.9 percent of their total operating expenses.

The composite Consumer Price Index (CPI) for all telephone service dropped 0.3 percent from 1988 to 1989 (Table 8). The CPI for local service increased 0.6 percent during the same period, while intrastate toll service rates dropped 2.6 percent and interstate toll rates dropped 1.3

percent. Overall, since 1983, local rates have increased 44 percent, intrastate toll has dropped 3 percent, and interstate toll has dropped almost 30 percent. During the same time, the CPI for all items increased 22 percent. The overall price level for telephone service should be stable for the near term as long distance rates drop slightly, offsetting possible small increases in local rates.

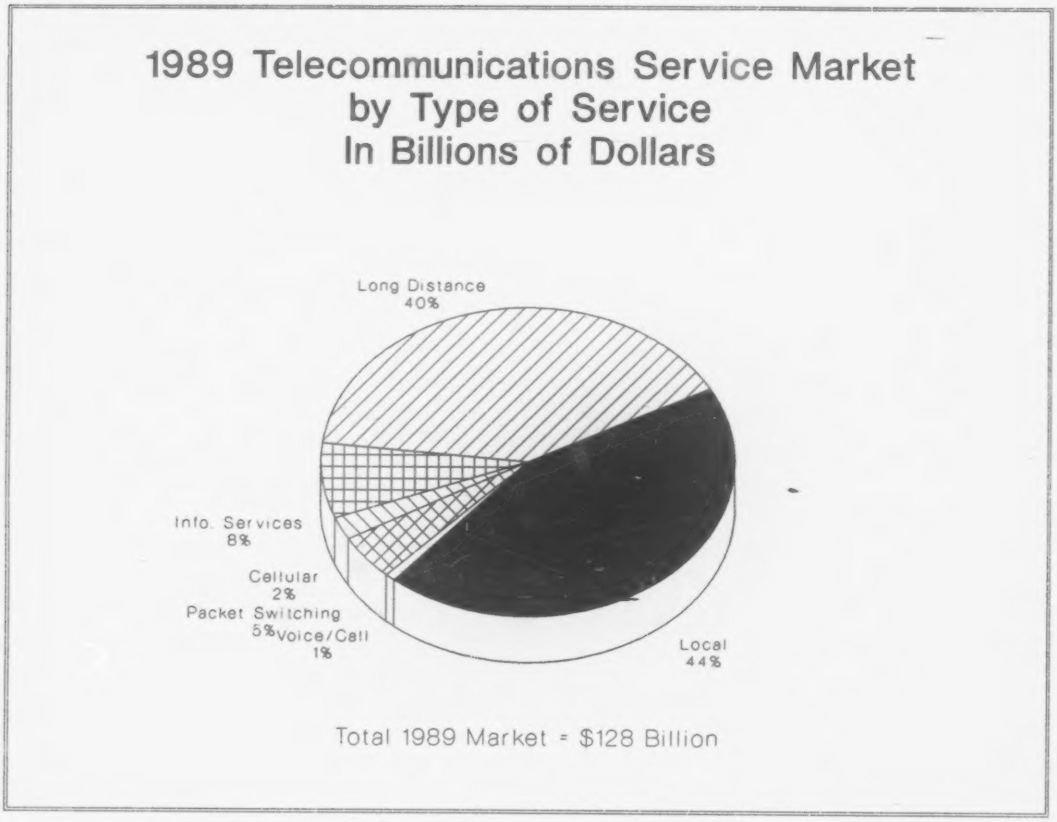
Since much of the telecommunications services industry is regulated, it has traditionally been guaranteed a certain rate of return. However, this is changing as certain segments of the telecommunications services market become more competitive. (Local exchange carriers are, for the most part, still guaranteed a certain rate of return.) Comparing 1987 with 1986 industry operating and financial ratios, it appears there is an overall deterioration in the health of the industry. In 1987, the cost of operations as a share of net sales amounted to 33.8 percent, up from 28.9 percent for 1986. Net profit as a percent of net sales dropped from 5.9 percent in 1986 to 1.1 percent in 1987. Return on equity decreased from 4.7 percent to 2.9 percent.

Technological convergence has reduced the structural differences between the data processing and telecommunications industries, leading to overlapping markets and customers. The technical interaction of computing and telephony can be characterized by the functional allocation of processing "intelligence" within the telecommunications network. In the new generation of telephone technology, remotely distributed digital processors are programmed to function independently of central office switches, without the centralized signaling instructions that have defined traditional network architecture. In addition, the network provides interconnection for CPE ranging from computer terminals with data processing capabilities to facsimile terminals, voice messaging systems, integrated voice-data work stations, and PBXs.

One of the key market developments in the past two years has been the testing of technical standards for the ISDN. By mid 1990, there were almost 200 ISDN customers (see Fig. 7). ISDN is directed primarily at the standardization of interfaces and services of a public digital network designed to provide an end-to-end digital pipeline for the transmission of voice, data, video, image, and text. In addition, aside from the wide variety of services a user will be able to access, ISDN will provide users with direct control over their services. For instance, users will be able to initiate and terminate services of their choice from their own terminals. While many of the network standards have been established, the standards for terminal equipment have not. It is likely that ISDN will not be available on a wide-spread commercial basis for several more years. In the long run, however, most analysts believe ISDN will become a major economic and technological force driving competition in the telecommunications industry.

Others, however, feel the customer does not want or need anything more than "plain old telephone service" (POTS), but nonetheless will be required to foot the bill for the development of ISDN, which will primarily benefit large business customers. Furthermore, critics argue the full benefits of ISDN will not be realized until every potential household and business has subscribed, and that may never happen.

Figure 6



1989 Telecommunications Service Market by Type of Service In Billions of Dollars

Total 1989 Market = $128 Billion

Figure 7

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING COMPANY	COMPANY	LOCATION	START	CO-SWITCH	TYPE	STATUS	#LINES
	Bell of Penn.	Mellon Bank	Pittsburgh, PA	11/88	AT&T SESS	BRI	TR	NA
	Bell of Penn.	2 X NA	Philadelphia, PA	12/89	AT&T SESS	BRI	CS	N
BELLSOUTH	Southern Bell	AT&T Network Systems	Atlanta, GA	3/88	AT&T SESS	BRI	LCS*	600
	Southern Bell	Contel	Atlanta, GA	3/88	AT&T SESS	BRI	LCS	53
	Southern Bell	Digital Equipment Corp.	Atlanta, GA	3/88	AT&T SESS	BRI	LCS	25
	Southern Bell	Internal	Atlanta, GA	6/87	AT&T SESS	BRI	Test	NA
	Southern Bell	Internal	Atlanta, GA	5/88	NT DMS-100	BRI	Test	NA
	Southern Bell	Internal	Boca Raton, FL	11/87	Siemens EWSD	BRI	Test	NA
	Southern Bell	Heathrow	Lake Mary, FL	11/88	NT DMS-100	BRI	Test	10
	Southern Bell	Digital Communications Assoc.	Atlanta, GA	1/89	AT&T SESS	BRI	LCS	2
	Southern Bell	NEC	Atlanta, GA	1/89	AT&T SESS	BRI	LCS	15
	Southern Bell	University of Florida	Gainesville, FL	4Q89	NT DMS-100	BRI	LCS	4
	Southern Bell	General Services Admin.	Atlanta, GA	11/89	NT DMS-100	BRI	NA	6
	South Central Bell	Internal w/ Bell South Svcs.	Birmingham, AL	2Q89	AT&T SESS	BRI	Test	325
	South Central Bell	U.S. Army Redstone Arsenal	Huntsville, AL	6/89	AT&T SESS	BRI	LCS	NA
	South Central Bell	Federal Express	Memphis, TN	5/90	NT DMS-100	PRI	TR	NA
	South Central Bell	Univ. of Tenn. Medical Ctr.	Memphis, TN	6/90	SESS/DMS-100	BRI	TR	NA
	South Central Bell	Golden Triangle Reg. Med Ctr.	Columbus, MS	8/90	AT&T SESS	BRI	LCS	NA
	South Central Bell	Intergraph	Huntsville, AL	6/90	AT&T SESS	BRI	LCS	NA
NYNEX	New York Tel.	Eastman Kodak	New York, NY	4Q90	AT&T SESS	BRI	TR	20
	New York Tel.	Manufacturers Hannover	New York, NY	4Q90	AT&T SESS	BRI	TR	20
	New York Tel.	Young & Rubicam	New York, NY	4Q90	AT&T SESS	BRI	TR	10
	New York Tel.	Shearson Lehman, Hutton	New York, NY	3Q90	SESS/DMS-100	BRI/PRI	TR	20
	New York Tel.	Shearson Lehman, Hutton	New York, NY	1Q89	SESS/DMS-100	BRI	LCS	5
	NY&New England Lab	Internal	New York, NY	1Q89	AT&T SESS	BRI/PRI	Interworking Test	
	New England Tel.	AT&T Facilities	Merrimack Val.	4Q88	AT&T SESS	BRI	LCS	1,000
	New England Tel.	Internal	Boston, MA	3Q90	AT&T SESS	PRI	Test	NA
	New England Tel.	Microcom	Boston, MA	1Q89	AT&T SESS	BRI	CS	100
	New England Tel.	Commerce Insurance Group	Webster, MA	2Q89	AT&T SESS	BRI	TR	50
	New England Tel.	State of New Hampshire	Concord, NH	2Q89	AT&T SESS	BRI	TR	6
	New England Tel.	Harvard University	Cambridge, MA	4Q89	AT&T SESS	BRI	TR	3,400
	New England Tel.	NYNEX Info. Resources	Middletown, MA	1Q90	AT&T SESS	BRI	TR	480
	New England Tel.	Amherst College	Amherst, MA	2Q90	AT&T 5ESS	BRI	TR	25
PACIFIC TEL	Pacific Bell	City of Fresno	Fresno, CA	4/89	AT&T 5ESS	BRI	CS	730
	Pacific Bell	AT&T Network Systems	Sunnyvale, CA	4/90	AT&T 5ESS	BRI	CS	1,100
	Pacific Bell	Aerospace	El Segundo, CA	11/89	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Xerox	Palo Alto, CA	12/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Tekelec	Los Angeles, CA	7/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Northern Telecom	San Ramon, CA	4/90	NT DMS-100	BRI	CS	NA
	Pacific Bell	Apple Computer	Sunnyvale, CA	5/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Hayes Microcomputer	Sunnyvale, CA	5/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Jet Propulsion Laboratories	La Canada, CA	12/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Ricoh	San Jose, CA	8/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Compression Labs, Inc.	Sunnyvale, CA	8/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	First Interstate Bank	Fresno, CA	12/90	AT&T 5ESS	BRI	CS	NA
SOUTHWESTERN B	Southwestern Bell	AT&T Technologies	Oklahoma City, OH	7/88	AT&T 5ESS	BRI	CS	1,000
	Southwestern Bell	Tenneco	Houston, TX	6/88	AT&T 5ESS	BRI	CS	3,900
	Southwestern Bell	3M Corporation	Austin, TX	7/88	AT&T 5ESS	BRI	CS	3,165
	Southwestern Bell	Shell Oil	Houston, TX	9/88	AT&T 5ESS	BRI	CS	6,650
	Southwestern Bell	AT&T Network Systems	St. Louis, MO	11/88	AT&T 5ESS	BRI	CS	2,300
	Southwestern Bell	Rockwell International	Dallas, TX	12/88	AT&T 5ESS	BRI	CS	1,200
	Southwestern Bell	Hermann Hospital	Houston, TX	1/89	AT&T 5ESS	BRI	CS	260
	Southwestern Bell	Methodist Hospital	Houston, TX	1/89	AT&T 5ESS	BRI	CS	200
	Southwestern Bell	Univ. of Texas/Houston	Houston, TX	11/89	AT&T 5ESS	BRI	CS	485
	Southwestern Bell	Valero	San Antonio, TX	12/89	AT&T 5ESS	BRI	CS	267
	Southwestern Bell	IBM	Austin, TX	2/90	AT&T 5ESS	BRI	CS	200
	Southwestern Bell	Mitchell Energy	Houston, TX	3/90	AT&T 5ESS	BRI	CS	679
	Southwestern Bell	Datapoint	San Antonio, TX	3/90	AT&T 5ESS	BRI	CS	350
	Southwestern Bell	Shell (Deer Park)	Houston, TX	3/90	AT&T 5ESS	BRI	CS	993
	Southwestern Bell	Kerr McGee Corp	Oklahoma City, OH	5/90	NT DMS-100	BRI	CS	400
	Southwestern Bell	SWBT Advanced Technology Lab	St. Louis, MO	4/88	AT&T 5ESS	BRI/PRI	Internal	50
	Southwestern Bell	SWBT Advanced Technology Lab	St. Louis, MO	4/88	NT DMS-100	BRI/PRI	Internal	50
	Southwestern Bell	SWBT Advanced Technology Lab	St. Louis, MO	4/88	Siemens EWSD	BRI/PRI	Internal	50

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
AMERITECH	Illinois Bell	McDonald's Corp	Oak Brook, IL	8/88	AT&T 5ESS	BRI*	CS*	2,696
	Illinois Bell	Progressive Computing	Oak Brook, IL	10/88	AT&T 5ESS	BRI	CS	10
	Illinois Bell	AT&T Bell Labs	Naperville, IL	4/89	AT&T 5ESS	BRI	CS	10,500
	Illinois Bell	Internal	NA*	4Q88	AT&T 5ESS	BRI	CS	250
	Illinois Bell	NA	NA	4Q88	AT&T 5ESS	BRI	CS	170
	Illinois Bell	NA	NA	4Q88	AT&T 5ESS	BRI	CS	400
	Illinois Bell	Motorola	Schaumburg, IL	4Q88	5ESS & DMS100	BRI	CS	50
	Illinois Bell	Northern Telecom	Schaumburg, IL	4Q89	NT DMS-100	BRI	CS	NA
	Illinois Bell	Internal	NA	4Q88	NT DMS-100	BRI	CS	60
	Illinois Bell	NA	NA	4Q88	AT&T 5ESS	BRI	CS	50
	Illinois Bell	NA	Chicago, IL	3Q89	AT&T 5ESS	BRI	CS	46
	Illinois Bell	City of Naperville	Naperville, IL	3Q89	AT&T 5ESS	BRI	CS	64
	Illinois Bell	Mitel	Oak Brook, IL	5/90	AT&T 5ESS	BRI	CS	2
	Illinois Bell	AT&T	Oak Brook, IL	12/90	AT&T 5ESS	BRI	CS	75
	Illinois Bell	Chicago Bridge & Iron	Oak Brook, IL	9/88	AT&T 5ESS	BRI	CS	3
	Illinois Bell	Teleos	Rolling Meadows, IL	1Q90	AT&T 5ESS	BRI	CS	2
	Illinois Bell	AT&T	Rolling Meadows, IL	11/90	AT&T 5ESS	BRI	CS	290
	Illinois Bell	AT&T	Chicago, IL	3/90	AT&T 5ESS	BRI	CS	70
	Illinois Bell	S&H Motivation	Hillside, IL	5/89	AT&T 5ESS	BRI	CS	180
	Illinois Bell	Northern Trust	Chicago, IL	2Q90	AT&T 5ESS	BRI	CS	2,000
	Illinois Bell	Chicago Title and Trust	Chicago, IL	4/90	AT&T 5ESS	BRI	TR	50
	Illinois Bell	Michael Reese Hospital	Chicago, IL	3/90	AT&T 5ESS	BRI	CS	31
	Illinois Bell	1st Chicago Futures	Chicago, IL	9/89	AT&T 5ESS	BRI	CS	45
	Illinois Bell	1st National Bank	Chicago, IL	5/90	AT&T 5ESS	BRI	CS	1
	Indiana Bell	Indiana University	Bloomington, IN	6/89	NT DMS-100	BRI	CS	50/1400
	Indiana Bell	Internal	South Bend, IN	1Q89	AT&T 5ESS	BRI	CS	47
	Indiana Bell	Citimark Development Corp	Fishers, IN	1Q89	AT&T 5ESS	BRI	CS	52
	Michigan Bell	Internal	Ann Arbor, MI	1Q89	AT&T 5ESS	BRI	CS	52
	Michigan Bell	NA	Southfield, MI	1Q89	AT&T 5ESS	BRI	TR	40
	Michigan Bell	Allied Signal	Southfield, MI	2Q89	NTDMS-100	BRI	TR	55
	Michigan Bell	University of Michigan	Ann Arbor, MI	3Q89	AT&T 5ESS	BRI	CS	317
	Michigan Bell	Michigan State Univ.	East Lansing, MI	1Q90	NT DMS-100	BRI	CS	4
	Michigan Bell	Flint Community Schools	Flint, MI	4Q90	AT&T 5ESS	BRI	CS	125
	Michigan Bell	Internal	Southfield/Troy, MI	4Q88	AT&T 5ESS	BRI	TR	20
	Ohio Bell	Internal	Cleveland, OH	4Q88	AT&T 5ESS	BRI	CS	35
	Ohio Bell	NA	Cleveland, OH	4Q88	AT&T 5ESS	BRI	CS	25
	Ohio Bell	NA	Columbus, OH	2Q89	AT&T 5ESS	BRI	CS	855
	Ohio Bell	NA	Columbus, OH	3Q89	AT&T 5ESS	BRI	CS	100
	Ohio Bell	NA	Columbus, OH	4Q89	AT&T 5ESS	BRI	CS	80
	Wisconsin Bell	Lawrence University	Appleton, WI	6/89	AT&T 5ESS	BRI	CS	47
	Wisconsin Bell	AT&T Sales	Milwaukee, WI	1/89	AT&T 5ESS	BRI	CS	17
	Wisconsin Bell	Amity Leather	West Bend, WI	11/89	AT&T 5ESS	BRI	CS	15
	Wisconsin Bell	State of Wisconsin	Madison, WI	2/90	AT&T 5ESS	BRI	TR	2
	Wisconsin Bell	Appleton Area Schools	Appleton, WI	4/90	AT&T 5ESS	BRI	CS	15
	Wisconsin Bell	NA	NA	4Q89	NT DMS-100	BRI	TR	26
BELL ATLANTIC	New Jersey Bell	Bellcore Research	Navesink, NJ	1/88	Siemens EWSD	BRI	CS	136
	New Jersey Bell	AT&T Bell	3 NJ Locations	2nd half 1990	AT&T 5ESS	BRI	CS	NA
	New Jersey Bell	NA	NA	NA	AT&T 5ESS	BRI	CS	NA
	New Jersey Bell	AT&T Consumer Products	Holmdel, NJ	12/88	AT&T 5ESS	BRI	CS	63
	New Jersey Bell	TELEOS	Holmdel, NJ	5/89	AT&T 5ESS	BRI	CS	15
	New Jersey Bell	AT&T	Newark, NJ	1990	AT&T 5ESS	BRI	CS	NA
	New Jersey Bell	Westinghouse	Morristown, NJ	11/89	AT&T 5ESS	BRI	CS	4
	C&P	Commonwealth of VA	Richmond, VA	4/88	AT&T 5ESS	BRI	CS	800
	C&P	John Hopkins Medical Inst.	Baltimore, MD	7/88-7/89	AT&T 5ESS	BRI	CS	NA
	C&P	W. Virginia University	Morgantown, WV	6/88	AT&T 5ESS	BRI	CS	85/660
	C&P	3 internal	Colesville, MD	2Q89	AT&T 5ESS	BRI	Internal	760
	C&P	Fannie Mae	Washington, DC	6/88	AT&T 5ESS	BRI	CS	NA
	C&P	GSA/WITS	Washington, DC	2Q90	AT&T 5ESS	BRI	CS	1,000
	C&P	NA	Virginia	NA	AT&T 5ESS	BRI	CS	NA
	C&P	15 X NA	NA	NA	AT&T 5ESS	BRI	CS	NA
	C&P	Internal	NA	7/88	NT DMS-100	BRI	CS	14
	C&P	Catholic University	Washington, DC	NA	AT&T 5ESS	BRI	NA	11
	Bell of Penn.	NA	Harrisburg, PA	7/88	NT DMS-100	BRI	TR	50
	Bell of Penn.	NA	Philadelphia, PA	6/89	AT&T 5ESS	BRI	CS	6
	Bell of Penn.	NA	Philadelphia, PA	6/89	AT&T 5ESS	BRI	CS	200
	Bell of Penn.	Carnegie Mellon Univ.	Pittsburgh, PA	8/88	AT&T 5ESS	BRI	TR	3
	Bell of Penn.	Westinghouse	Pittsburgh, PA	4Q88	AT&T 5ESS	BRI	TR	NA

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
	Southwestern Bell	AT&T Network Systems	Dallas, TX	4/90	AT&T 5ESS	BRI	CS	30
	Southwestern Bell	Systematics	Little Rock, AR	8/90	AT&T 5ESS	BRI	CS	200
	Southwestern Bell	Zocom Technologies	Dallas, TX	7/90	AT&T 5ESS	BRI	CS	200
	Southwestern Bell	AT&T Microelectronics	Dallas, TX	5/90	AT&T 5ESS	BRI	CS	225
	Southwestern Bell	Vadis	Dallas, TX	1/90	AT&T 5ESS	BRI	CS	260
	Southwestern Bell	Interclaim	Dallas, TX	1/90	AT&T 5ESS	BRI	CS	159
US WEST	US West Comm.	American Credit Bureau	Phoenix, AZ	9/89	NT DMS-100	PRI	CS	NA
	US West Comm.	Boeing Co.	Seattle, WA		AT&T 5ESS	BRI	CS	860
	US West Comm.	Boulder Valley	Boulder, CO		AT&T 5ESS	BRI	Pending	26
	US West Comm.	City of Colorado Springs	Colorado SP, CO		AT&T 5ESS	BRI	Pending	
	US West Comm.	Control Data Corporation	Minneapolis MN		AT&T 5ESS	BRI	CS	2
	US West Comm.	City of Denver	Denver, CO		AT&T 5ESS	BRI	Pending	400
	US West Comm.	Intel Corp.	Chandler, AZ		AT&T 5ESS	BRI	Pending	
	US West Comm.	Intermountain Health Care	Salt Lake City, UT		NT DMS-100	BRI	CS	6
	US West Comm.	Martin Marrietta	Denver, CO		AT&T 5ESS	BRI	Pending	4
	US West Comm.	Microwave Inc	Des Moines, IA		AT&T 5ESS	BRI	CS	3
	US West Comm.	State of Minnesota	Minneapolis, MN		AT&T 5ESS	BRI	Pending	20
	US West Comm.	Mullen Telecommunications	Denver, CO		AT&T 5ESS	BRI	CS	2
	US West Comm.	State of Nebraska	Omaha, NE		AT&T 5ESS	BRI	Pending	20
	US West Comm.	Rocky Flats Weapons Plant	Broomfield, CO		AT&T Definity	PRI	CS	8
	US West Comm.	Star Tribune	Minneapolis, MN	11/89	AT&T Definity	PRI	CS	9
	US West Comm.	University of Arizona	Tucson, AZ		AT&T 5ESS	BRI	CS	2,008
	US West Comm.	U.S. Bank of Oregon	Seattle, WA		NT DMS-100	BRI	CS	40
	US West Comm.	Vectra Banking Corporation	Seattle, WA		AT&T 5ESS	BRI	CS	68
	US West Comm.	AT&T Network Systems	Denver, CO	9/88	AT&T 5ESS	BRI/PRI	CS	
	US West Comm.	AT&T Omaha Works	Omaha, NE	6/89	AT&T 5ESS	BRI	CS	
	US West Comm.	3M Corporation	St. Paul, MN	8/88	AT&T 5ESS	BRI	CS	
	US West Comm.	ACB Companies	Phoenix, AZ	9/89	NT DMS-100	BRI	CS	
	US West Comm.	Department of Energy	Denver, CO	12/89	AT&T 5ESS	BRI	CS	
	US West Comm.	AT&T Communications	Seattle, WA	5/90	AT&T 5ESS	BRI/PRI	CS	

Reprinted from ISDN News with permission from Phillips Publishing, Potomac, MD.

LOCAL EXCHANGE MARKET

LOCAL EXCHANGE MARKET

Overview

The local exchange marketplace is comprised of the services provided by local exchange telephone companies (LECs). LECs are monopoly service providers within franchised areas that operate in an environment governed by both state and national regulations. Companies which once comprised the Bell Telephone System can provide services only within, and not between, specific operating regions called Local Access and Transport Areas (LATAs). Each Bell Operating Company (BOC) may operate within more than one LATA. Within each area, a telephone company provides a variety of services. These services can be divided into two basic categories--exchange services and exchange access services. Exchange services are the telecommunications services provided within the serving area, while exchange access services connect customers to long distance carriers. The services themselves range from simple dial tone to specialized customer services and system features such as hunt groups, call waiting, call forwarding, and centrex. In addition, in 1988 BOCs were given permission under specific conditions to provide voice messaging services and gateways for certain other enhanced services.

In 1989, the total nationwide local exchange market (including intraLATA toll) amounted to some $56 billion (see Fig 8). This can be divided into two general segments--residential and business markets. For all carriers combined, the residential market represents the largest portion, accounting for 55 percent of the total. (See Table 10 for a gauge of the relative size of the business and residential portions for the top 30 cities.) For the most part, the residential portion of the market is basic dial tone service. Some LECs offer certain advanced residential services, but they are new and household penetration is very low. These services, such as call forwarding, call waiting, voice messaging, etc., are likely to grow in popularity and provide the impetus for growth in the residential services segment.

In 1989, the business telecommunications services segment of the market amounted to $25 billion. At $10 billion, the largest portion of the business services market is basic business lines used principally by small businesses in conjunction with a key system or single-line instruments. Other significant portions of the business telecommunications services segment include revenue from WATS (wide area telecommunications service) at $4 billion, centrex and payphone service, each at $3 billion, private line service at $2 billion, and PBX trunk revenue at $1 billion. The balance is accounted for by a variety of services, including certain digital, voice processing, and gateway services, providing much of the momentum for near-term growth in the business segment of the telecommunications services market.

Regulated Local Exchange Carriers

There are hundreds of companies across the United States offering local telephone service. In general, they can be grouped into two categories--the LECs which were divested from AT&T in 1984, commonly called the Bell Operating Companies (BOCs), and the independent telephone companies such as GTE, Centel, and Contel. There are 22 BOCs grouped into seven regional holding companies, commonly called RBOCs, and hundreds of independent telephone companies (see Table 11 for a listing of the top 150 LECs). The RBOCs control an estimated 80 percent or more of the local exchange business. One of the most significant developments of 1990 was the announced acquisition of Contel by GTE. This transaction will create the largest local exchange company in the United States by virtually every measure and represents the most significant milestone in a trend in the telephone industry of increased consolidation through acquisition and merger.

The seven RBOCs are Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis (commonly called PacTel), Southwestern Bell, and U S West. In 1989, total revenue for all RBOCs amounted to $77.1 billion, up from $73.1 billion reported in 1988 (see Table 9 and Fig. 9). At $30.5 billion, the largest source of revenue was local service, followed by the $18.6 billion paid by long distance carriers for access to the local network. BellSouth and NYNEX earned the most revenue, more than $13 billion each. In addition, the RBOCs continue to be profitable: the range of net income as a percent of revenue for 1989 varied from a low of 6 percent for NYNEX to a high of 13 percent for PacTel and Southwestern Bell.

In terms of total revenue in 1989, the largest independent telephone companies were GTE ($17.4 billion), United Telecommunications ($7.5 billion), Contel ($3.1 billion), and Centel ($1.2 billion). Total estimated 1989 revenue for all independent telephone companies amounted to $39.5 billion (see Table 12). Of the top four, profitability varied greatly from a high of 37 percent of revenue for Centel to a low of 4.8 percent for United. Virtually all the fluctuation in profitability is related to revenue and expenses from nonlocal exchange business.

Despite the continued and relatively stable profitability of local telephone service, the local exchange carriers are conducting business in an uncertain enviroment. Issues such as bypass, CPE distribution, ISDN, service pricing deregulation and regulation, enhanced services, constraints resulting from the Consent Decree of the AT&T divestiture, sales agency, and international opportunities all provide the RBOCs and independents with a very complex environment. As the companies meet these challenges and opportunities, they will undoubtedly derive more of their revenue from sources other than local telephone service. In fact, some estimates project that by 1995 only 65 percent of RBOC revenues will be derived from local exchange business.

Bypass

One of the issues critical to regulated LECs is bypass. Businesses are beginning to bypass the services provided by the local operating company. Bypass is usually considered to be of two types--facility bypass and switched services bypass.

Facility bypass occurs when a customer elects to bypass some or all of the local telco's facilities with its own network and either ties into the network somewhere along the line, usually at the long-distance carrier's point of presence, or bypasses the network on an end-to-end basis. Local telcos usually divide facility bypass into switched facility bypass and private line bypass. The total 1989 estimated loss to the telcos from facility bypass amounted to $1.7 billion.

Switched service bypass occurs when a customer uses a higher-capacity, telco-provided service or telco-leased private lines to bypass lower-capacity, higher-priced services. The total 1989 estimated loss to the telcos from switched service bypass amounted to $2.3 billion.

CPE Distribution

All RBOCs have been active in CPE distribution. They have collectively achieved sales of some $1.9 billion, or about 10 percent of the entire CPE marketplace (including all voice and data CPE). These sales have been achieved through in-house joint services/CPE marketing organizations and through acquisitions of independent distribution organizations, *i.e.*, interconnects. While the RBOCs have had a some success with CPE sales across the country, the successes have been spotty even in their own regions. In 1990, U S West gave up its CPE distribution business to small business customers within its own terratory. The RBOCs have been even less successful outside their own franchise areas. In fact, Ameritech recently sold its entire non-Ameritech-territory imbedded base of equipment. It seems clear that the RBOCs will continue to sell some CPE, but it is not clear that they will be any more financially successful at it than other CPE vendors, especially outside their own regions, where they have no installed customer base. Further discussion of RBOC CPE activities is included in the section on CPE.

ISDN

As mentioned in the overview to the section on telecommunications services, ISDN is undergoing a number of trials throughout the country. For the RBOCs, ISDN penetration is gaining momentum. By mid 1990, the total number of ISDN lines in place exceeded 90,000. Ameritech and Southwestern Bell have taken significant leadership roles, with 36,000 and 23,000 ISDN lines respectively. PacTel has been the least active, with less than 1,500 ISDN lines.

Not only does the number of RBOC-sponsored ISDN trials continue to grow, but the RBOCs are also beginning to lure large business customers to digital centrex with the promise that digital centrex is the path to ISDN services. As the progression towards ISDN continues, the RBOCs will continue to replace analog switches with digital switches. The percentage of

RBOC access lines served by digital switches increased from less than 25 percent in 1988 to about 50 percent in 1990. By 1994, it should exceed 60 percent (see table 17).

Service Pricing Regulatory Trends

The pricing structure of most local telephone services is currently regulated by state public utility commissions (PUCs). LECs must file tariffs with their PUC explaining the service to be provided and the price structure for the service. If the PUC approves the tariff, the LEC can begin offering the service. An increasing number of PUCs are being persuaded that, at least for some local services, such steps as measured pricing, off-tariff pricing, and even totally detariffed pricing are needed to ensure that the local telco is able to remain financially sound in an increasingly competitive environment. In fact, the state of Nebraska is setting a trend by removing all telcos from most PUC rate regulation. Fifteen other states have detariffed at least some local services, and other states are considering similar action.

Efforts to increase the ability to offer flexible service pricing and/or measured service pricing are being made by all RBOCs. NYNEX has foregone some price increases in exchange for measured service in New York. Ameritech has also achieved measured service (except for a three-year ban in Indiana). U S West has made significant progress not just in Nebraska, but in New Mexico and other states as well. Even the California PUC, a traditional stronghold of telephone regulation, has been moving toward pricing flexibility on nonessential services.

Enhanced Services

Deregulatory and reregulatory trends of the late 1980s allowed the RBOCs to offer certain enhanced services directly (without having to market through a separate subsidiary), provided they comply with certain nonstructural safeguards including the requirement of comparably efficient interconnection (CEI). This gave third party vendors the ability to interconnect to the network features necessary to provide the services under the same conditions. Each time an RBOC wanted to offer an enhanced service directly it had to file a CEI plan with the FCC. In 1990, this process was disrupted when the 9th Circuit U.S. Appeals Court remanded the FCC's decision to allow the RBOCs to market regulated network services and enhanced services jointly. As of this writing, the issue has not been fully resolved. Despite this disruption, the RBOCs continue to file CEI plans with the FCC. Figure 12 lists the RBOC CEI plans filed as of early 1989.

Sales Agency

Another competitive safeguard required of the RBOCs wishing to sell equipment and regulated communication services together through a direct sales channel is the mandate that they must provide the opportunity to sell network services to independent sales agents. These independent agents, typically CPE vendors (*i.e.*, interconnects), are chosen by the RBOC and are given specific network services they are allowed to sell. The agent earns a commission from the RBOC on the sale of its network services.

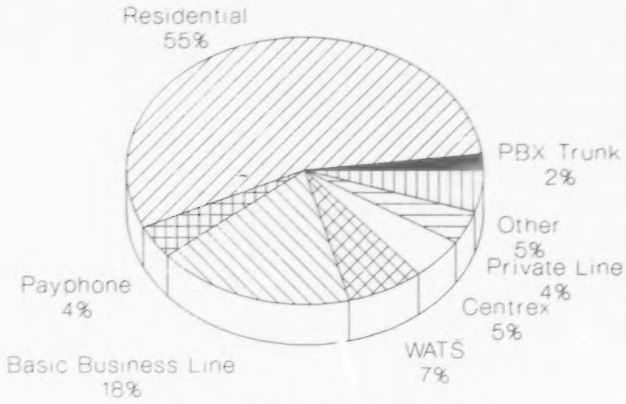
The sales agency program has delivered a significant volume of sales for several of the RBOCs. In 1988, independent agents brought in a total of $141 million in revenue to the RBOCs and earned $22 million in commissions for themselves. This performance is up considerably from 1987's $32 million to the telcos and $4.2 million in agent commissions. Estimates for 1989 are even rosier. Revenues to the telcos should amount to about $425 million, with commissions to the agents of about $65 million.

International Opportunities

All the RBOCs have organized international subsidiaries to explore new opportunities in foreign markets (see section on international developments). While the extent of the activity has been modest to date, the international forays are nonetheless strategically important. Unlike many of their activities in the Unites States which are subject to regulation, the RBOCs see the potential to participate more freely in the international telecommunications marketplace. Moreover, many markets abroad are growing more rapidly than those in the United States. In general, most foreign countries are hampered by a lower level of technology than the United States and need RBOC expertise to develop a modern, sophisticated telecommunications infrastructure. A sound telecommunications infrastructure has been determined to be an absolute requirement to attract business investment and ensure a sound economy.

Figure 8

1989 Local Exchange Services Market, by Type of Service

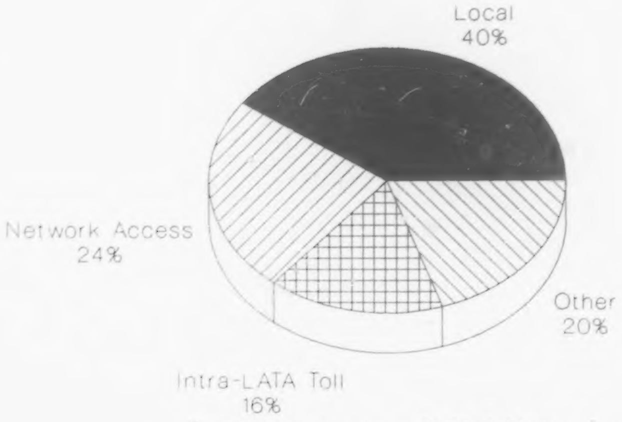


Total Market = $56 Billion

Source: Estimated by the NATA Market Research Dept. based on various sources

Figure 9

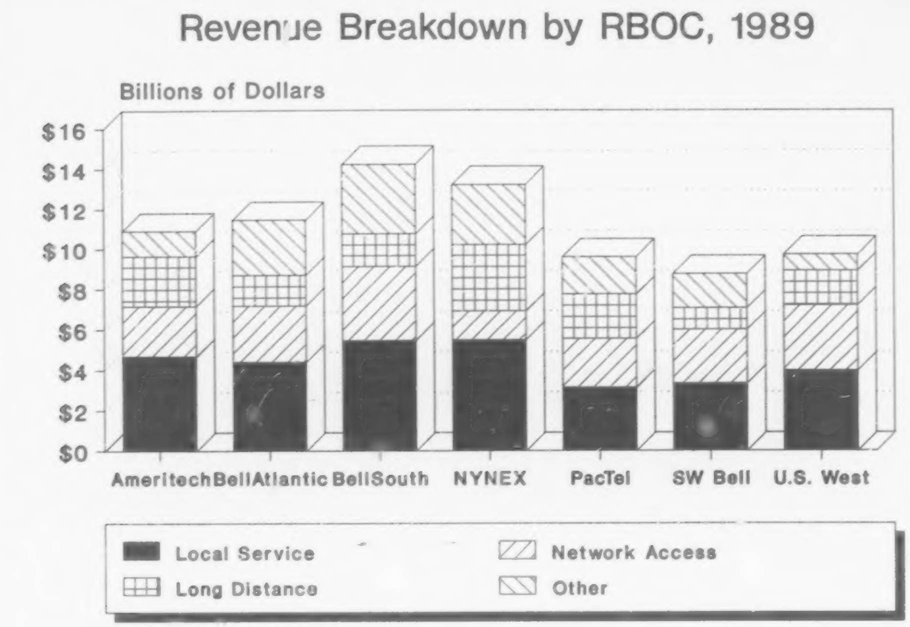
1989 RBOC Revenue, by Source



Total Revenue = $77.1 Billion

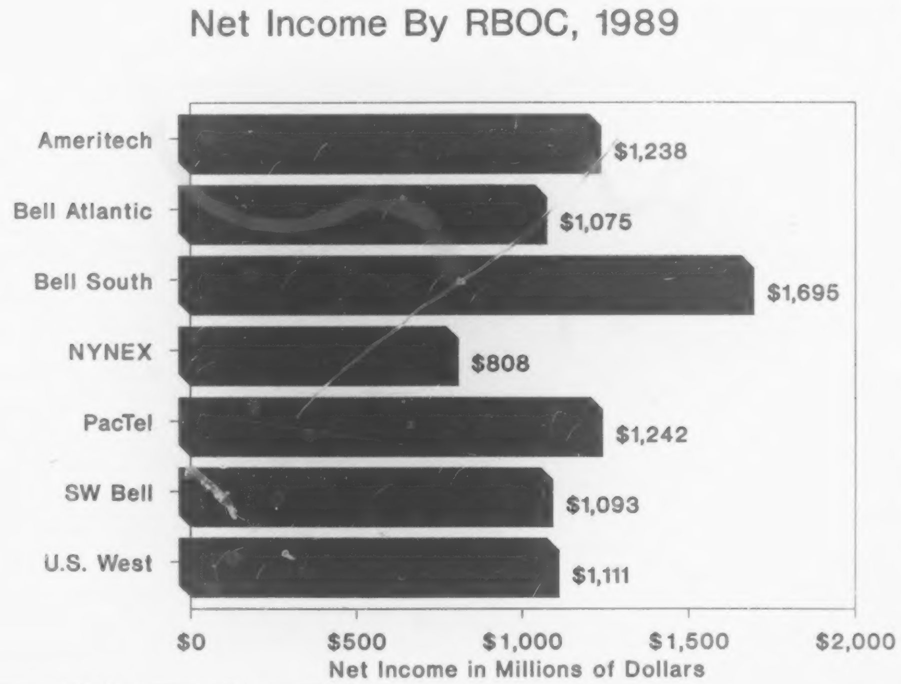
Source: Company Annual Reports

Figure 10



Source: Individual Annual and 10K
Company Reports

Figure 11



Source: Indvid. Annual and Co. Reports

Figure 12

ENHANCED SERVICES SCOREBOARD

COMPANY	NAME/SERVICE	LOCATION
Ameritech	Voice messaging	Milwaukee, Wis., (westside); Brookfield, Wis. (Milwaukee area); Chicago suburbs: Worthington and Westerville, Ohio (Columbus area); Indianapolis and Carmel, Ind. (Indianapolis area)
	Heartland/videotex gateway	Peoria County, Ill.
	Touch Four/talking yellow pages	Green Bay, Madison, Milwaukee, Appleton, Wis.; Grand Rapids, Detroit metro area, Lansing, Holland, Grand Haven, Mich.; South Bend, Indianapolis, Ind.; Cleveland, Columbus, Ohio; western and northern Illinois
	Coin messaging	Columbus, Ohio
Bell Atlantic	AnswerCall/residential voice mail	Norfolk Va., Richmond, Va., Washington, D.C., suburbs in Md. and Va., suburban Philadelphia, and northern N.J.
	Intelligate/videotex gateway	Metropolitan Washington, D.C., Philadelphia/Delaware
	Electronic data interchange	Regionwide
	Send-A-Call/coin messaging	Washington, D.C.
	Talking Yellow Pages	Baltimore, Washington, D.C., Richmond, Tidewater, Va.
BellSouth	MemoryCall/voice messaging	West Palm Beach, Miami, Ft. Lauderdale and Gainesville, Fla.
	Class Notes/voice mail for schools	Atlanta, Memphis, Tenn.
	Transtext Universal Gateway (TUG)/videotex gateway	Atlanta
	Business TUG	Atlanta
	Message Central/electronic mail	Regionwide
	MemoryCall Public Telephone Service/coin messaging	Atlanta, New Orleans, Memphis, Tenn.
	CallFax/voice & facsimile response	Orlando, Fla.
Nynex	Info-Look/videotex gateway	Burlington, Vt., New York City, Boston
	Residential Call Answering & Business Call Answering/voice messaging	Boston, midtown Manhattan, suburban New York City
	FYI/talking yellow pages	Queens, Brooklyn, N.Y.
Pacific Telesis	Message Center/ residential voice mail	Milpitas, San Pedro, Calif.
	Pacific Bell Voice Mail (business)	San Francisco, Los Angeles, Sacramento, San Diego, Fresno, Santa Rosa, Orange County, Calif., Nevada
	Pacific Bell Connection/electronic messaging	San Francisco Bay Area
	California Call Management/voice store and forward	San Francisco, Los Angeles, Sacramento, San Diego
	Smart Talk/talking yellow pages	Sacramento, Calif.
Southwestern Bell	Voice messaging (business)	Dallas, Houston, San Antonio, Kansas City, St. Louis
	SelecTALK/talking yellow pages	Most major markets, some smaller markets
U S West	Voice messaging	Residential: Denver, Phoenix, Boise, Tucson, Albuquerque Small business (<100 lines): Denver, Omaha, Boise, Phoenix, Tucson, Albuquerque, Seattle, Colorado Springs Large business/government/education: Denver, Tucson, Phoenix, Albuquerque
	CommunityLink/videotex gateway	Omaha, Neb.
	Audio Options/voice-store-and-forward	Denver
	Electronic mail	Omaha, Neb.
	Talking Yellow Pages	Ten locations in major markets

Reprinted with permission from *Enhanced Services Outlook*, a publication of Telecom Publishing Group. For more information, contact TPG Circulation Dept., P.O. Box 1455, Alexandria, Va. 22313-2055, or telephone (703) 739-6400 or 1-800-327-7205.

© 1990 Telecom Publishing Group

TIME LINE	NEWS & NOTES
Trials began 2/89 in Milwaukee area, 6/89 in Chicago area, 11/89 in Columbus area, 9/89 in Indianapolis area, 4/90 in Detroit. Trial extension sought until 3/91 in Chicago area. Indiana Bell will seek to tariff service in 3Q/90. Began transmitting non-profit service 4/90. Trials started 4/89, debuted 11/88 in Green Bay, Wis., 8/90 in Jackson, Kalamazoo, Mich. Six-month trial began 2/90.	17 voice messaging providers in Ameritech region, including **Ameritech Voice Messaging.** Only head-to-head competition is in one Indianapolis CO. Milwaukee area vendor, **All City Communications,** has attracted 675 customers out of 30,000 potential; 95% of them are residential. Cost is $6 res., $12 business. Ameritech is providing promotional and technical assistance to videotex gateway operated by non-profit **Heartland Free-net.** Touch Four audiotex gateway now available in 32 yellow pages directories in 11 markets. It handles over 1 million calls per month.
Trials began 1Q/89. Expanded rollout through 2Q/89 will include Washington, D.C., Harrisburg, Pittsburgh and Philadelphia, Pa., northern Delaware and metro Baltimore. Market trials began 1/89. Rollout scheduled 10/90. Washington, D.C., trial started 7/90. Trial started 1990.	"Tens of thousands" of voice mail customers cited in FCC filing. Intelligate has 56 IPs and 5,000 customers in Penn. and Delaware, and 109 IPs and 4,000 customers in Washington, D.C. Send-A-Call rolled out in July in 250 Washington, D.C., area pay phone locations; next trial sites are Philadelphia and New Brunswick, N.J. Vendor providing audiotex for talking yellow pages is **BDR Videotex USA.**
Voice messaging service, approved 12/88, will be added 9/90 in Jacksonville, Fla.; 10/90 in Atlanta; by end of year in Huntsville, Ala., Louisville, Ky., Baton Rouge, La., and Nashville, Tenn. Trial of educator's voice mail service started 4/89. Service began 8/88. Testing at two unnamed companies in Atlanta. Offered through separate subsidiary. Trial began 12/89. 12-month trial began 10/89.	Memory Call instructions are now available in Spanish/English in Miami. No plans to offer Spanish option in other locations. Class Notes up and running in two elementary schools in Atlanta and Memphis. Number of gateway customers has been frozen at approximately 3,000 users in Atlanta, due to RHC's skepticism that gateway could ever be profitable in the currently restrictive environment. BellSouth says it has 36,300 enhanced service "customers." That number includes 30,000 voice mail customers, 3,000 customers for its TUG gateway, and 3,300 locations for its MemoryCall public telephone/coin messaging service.
Trials began 12/88 in Burlington, 4/89 in New York, 3/90 in Boston. Back Bay Boston and Waltham, Mass. commercial rollouts began 7/89; midtown NYC began 3/90; suburban NYC began 6/90. Trial started 1990.	50 advertisers have bought front of the page ads for vendor-provided talking yellow pages trial. 11,000 customers have accessed Info-Look in its three locations since its introduction. Info-Look director Ellen Powley says RHC will not consider more locations as long as current restrictions are in place because of cost of transmitting information.
Trials began 3/89. San Francisco rollout scheduled 3Q/90. In California since 11/88, Nevada since 11/89. Rollout in Riverside, Calif., 3Q/90. Trials began 9/88, commercial rollout 4Q/90. Since 9/89. 12-month trial ends 12/90.	Three Pacific Bell Voice Mail products available: Series 50, 100, and 200. Products are price per mailbox ($10.95 to $19.95) or per port ($150 to $200). Free installation offered businesses. Pac Bell Directory is reconsidering use of voice storage and retrieval systems after audiotex gateway proved unsatisfactory in Smart Talk trial, which is being suspended 12/90. Pac Bell is advertising 900/976 IPs by category in Bay Area, starting this month with sports.
Trials conducted 7/88 to 6/89. Commercial rollout 10/89. Business service to launch in Austin and Tulsa August 15. Fort Worth, Oklahoma City, Tulsa, Wichita, Topeka, and Little Rock will launch service by end of year. Trial started 1989.	San Antonio business voice mail activated Aug. 1. SelecTalk vendors are Dallas-based **Audio Services Inc.,** Dallas-based **Southern Audiotext Inc.,** and Wichita, Kan.-based **Brite Voice Systems.**
Boise trial started 3/89; Denver rollout 8/89; Phoenix 10/89; Albuquerque 6/90. Boise trial 5/89; Omaha 6/89; Denver 10/89; Phoenix 2/90; Tucson 4/90; Seattle 5/90; Colorado Springs, Albuquerque 6/90. Denver, Phoenix, Tucson 5/90; Albuquerque 6/90. Startup 11/89. 8-month trial began 6/89. Trial began 10/89.	RHC is currently debating where to open second gateway. Leading prospects are Seattle and Minneapolis. Omaha gateway currently has 104 IPs with 750 individual services, and 2,975 end-users. Enough terminals and software have been distributed for 4,700 users. Negotiations with **Lincoln Telephone** to provide gateway exchange when independent telco begins service at year-end have broken off because of technical, cost factors. Exchange of gateway service will likely be made available by independent service bureaus instead. Talking yellow pages provided by Salt Lake City-based **Voice Directory of America.**

Table 8

ANNUAL RATE OF CHANGE IN MAJOR PRICE INDEXES

YEAR	GNP FIXED WEIGHT PRICE INDEX	CONSUMER PRICE INDEX (CPI)					PRODUCER PRICE INDEX (PPI)		
		ALL ITEMS	ALL TELEPHONE SERVICES	LOCAL SERVICES	INTERSTATE TOLL SERVICE	INTRASTATE TOLL SERVICE	LOCAL RESIDENTIAL SERVICES	LOCAL BUSINESS SERVICES	TOLL SERVICE
1978	7.2%	9.0%	0.9%	1.4%	-0.8%	1.3%	3.1%	4.4%	-0.3%
1979	8.8	13.3	0.7	1.7	-0.7	0.1	1.6	2.2	-0.5
1980	9.8	12.5	4.6	7.0	3.4	-0.6	7.1	5.8	4.1
1981	8.5	8.9	11.7	12.6	14.6	6.2	15.6	15.7	10.8
1982	5.0	3.8	7.2	10.8	2.6	4.2	9.0	5.8	3.8
1983	3.9	3.8	3.6	3.1	1.5	7.4	0.2	2.2	1.6
1984	3.7	3.9	9.2	17.2	-4.3	3.6	10.4	24.1	-1.6
1985	3.6	3.8	4.7	8.9	-3.7	0.6	12.4	5.6	-0.8
1986	2.3	1.1	2.7	7.1	-9.4	0.3	8.9	2.5	-7.0
1987	4.0	4.4	-1.3	3.3	-12.4	-3.0	2.6	-0.8	-7.9
1988	4.5	4.4	1.3	4.5	-4.2	-4.2	4.6	0.5	-2.3
1989	4.1	4.6	-0.3	0.6	-1.3	-2.6	1.9	0.6	-0.1

NOTE -- THE GROSS NATIONAL PRODUCT (GNP) FIXED WEIGHT PRICE INDEX REFLECTS INFLATION THROUGHOUT THE ECONOMY, AND THE CPI FOR ALL ITEMS MEASURES THE IMPACT OF INFLATION ON CONSUMERS. THE CPI INDEX OF ALL TELEPHONE SERVICES IS BASED ON A "MARKET BASKET" INTENDED TO REPRESENT THE TELEPHONE RELATED EXPENDITURES OF A TYPICAL URBAN HOUSEHOLD. IT INCLUDES BOTH LOCAL AND LONG DISTANCE SERVICES. THE CPI INDEX OF LOCAL TELEPHONE CHARGES IS BASED ON MONTHLY SERVICE CHARGES, MESSAGE UNIT CHARGES, LEASED EQUIPMENT, INSTALLATION, ENHANCED SERVICES (SUCH AS TONE DIALING AND CALL WAITING), TAXES, SUBSCRIBER LINE CHARGES, AND ALL OTHER CONSUMER EXPENDITURES ASSOCIATED WITH TELEPHONE SERVICES EXCEPT LONG DISTANCE CHARGES. IN CONTRAST, THE PPI INDEX OF LOCAL RESIDENTIAL SERVICES IS BASED ONLY ON SERVICE CHARGES FOR RESIDENTIAL SERVICE, OPTIONAL TOUCH TONE SERVICE, AND SUBSCRIBER LINE CHARGES.

Source: FCC

Table 9

Selected Financial Information of the Regional Bell Operating Companies
As of December 31, 1989

	Ameritech	Bell Atlantic	Bell-South	NYNEX	PACTEL	SW Bell	US West	Total or Average
Revenue: $ Millons	10,211	11,449	14,228	13,211	9,593	8,730	9,691	77,113
Local Service: $ millions	4,679	4,405	5,480	5,494	3,130	3,325	3,957	30,470
Network Access: $ millions	2,482	2,778	3,644	1,411	2,410	2,659	3,229	18,613
Long Distance: $ millions	1,259	1,513	1,629	3,293	2,190	1,052	1,694	12,630
Other: $ millions	1,791	2,753	3,475	3,013	1,850	1,695	811	15,400
Expenses and Income Tax: $ millions	8,973	10,374	12,533	13,403	8,351	7,637	8,580	68,851
Net Income: $ millions	1,238	1,075	1,695	808	1,242	1,093	1,111	8,262
Earnings per Share: $	4.59	5.43	3.64	4.10	3.02	3.64	6.02	4.35
Dividends per Share: $	2.98	4.40	2.52	4.36	1.88	2.60	3.76	3.21
Avg. Shares Outstanding: millions	270	198	478	197	411	301	184	291
Total Assets: $ millions	19,833	26,200	30,050	25,909	21,200	21,200	25,410	24,257
Long Term Debt: $ millions	5,069	7,721	7,055	3,137	5,325	5,456	7,248	5,859
Customer Access Lines: thousands	15.9	17.1	17.0	15.0	14.2	11.8	12.2	14.7
Number of Employees: thousands	77.3	79.1	101.3	95.4	68.5	66.2	70.6	79.8

Source: Individual Annual and 10K Company Reports.

Table 10

Residential and Business Telephones Installed of Top 30 Metropolitan Areas, 1985, 1990 and 1995

City	1985		1990		1995	
	Residential (000)	Business (000)	Residential (000)	Business (000)	Residential (000)	Business (000)
Atlanta	715	375	865	409	942	446
Baltimore	1,153	410	1,264	450	1,309	466
Boston	299	251	353	300	382	325
Chicago	1,926	881	2,116	968	2,215	1,014
Cincinnati	550	234	625	266	656	280
Cleveland	655	258	707	278	723	285
Columbus	332	161	387	188	412	201
Dallas/Ft. Worth	907	293	1,080	349	1,176	380
Denver	1,186	499	1,336	613	1,466	691
Detroit	1,096	389	1,228	432	1,263	442
Houston	1,135	702	1,320	620	1,410	710
Indianapolis	477	199	544	228	568	238
Kansas City	325	194	364	218	428	229
Los Angeles	1,402	745	1,571	835	1,674	890
Miami	950	400	1,060	448	1,130	475
Milwaukee	619	255	677	279	707	292
Minneapolis/St. Paul	1,275	517	1,520	618	1,653	672
New Orleans	618	230	645	250	703	262
New York	4,056	1,825	4,344	1,954	4,520	2,033
Oklahoma City	587	242	690	285	750	310
Phoenix	1,211	400	1,640	543	1,907	632
Pittsburgh	554	264	605	288	625	298
Portland	343	202	404	244	440	269
Philadelphia	1,284	458	1,416	505	1,478	527
St. Louis	394	205	442	230	463	241
San Diego	411	234	513	293	571	326
San Francisco	521	420	592	478	636	514
San Jose	530	233	685	301	768	337
Seattle	452	295	554	362	606	395
Washington	549	624	634	722	679	773

Source: NATA Market Research Department.

Table 11

THE TOP 150

Largest Telephone Companies Reporting to USTA, Including Holding Companies

In Order of Access Lines[1] As of December 31, 1989	Access Lines	Operating Revenues
1. **Bell Atlantic Corp.** • Philadelphia, Pennsylvania	17,056,802	10,226,894,000
2. **BellSouth Corp.** • Atlanta, Georgia	16,720,367	11,995,872,345
3. **Ameritech Corp.** • Chicago, Illinois	15,899,000	9,353,339,000
4. **NYNEX** • New York, New York	14,960,953	11,086,660,000
5. **Pacific Telesis Group** • San Francisco, California	14,202,949	7,998,678,086
6. **US West Communications** • Englewood, Colorado	12,306,536	8,128,848,000
7. **GTE Corp. (US Only)** • Irving, Texas	12,300,000	9,558,000,000
8. **Southwestern Bell Corp.** • St. Louis, Missouri	11,444,061	7,408,690,000
9. **United Telecommunications, Inc.** • Overland Park, Kansas	3,811,980	2,365,400,000
10. **Contel Service Corp.** • Atlanta, Georgia	2,591,090	2,120,605,610
11. **Southern New England Telephone Co.** • New Haven, Connecticut	1,875,000	1,419,414,000
12. **Centel Corp.** • Chicago, Illinois	1,590,716	686,051,000
13. **ALLTEL Corp.** • Hudson, Ohio	1,123,590	801,575,000
14. **Puerto Rico Telephone Co.** San Juan, Puerto Rico	803,713	591,586,958
15. **Cincinnati Bell Telephone Co.** • Cincinnati, Ohio	781,064	489,119,931
16. **Rochester Telephone Corp.** • Rochester, New York	610,338	359,880,000
17. **Century Telephone Enterprises, Inc.** • Monroe, Louisiana	296,034	190,538,000
18. **Telephone & Data Systems, Inc.**† Chicago, Illinois	263,914	168,046,000
19. **Pacific Telecom, Inc.** * Vancouver, Washington	252,732	211,967,000
20. **Lincoln Telephone & Telegraph Co.** ** Lincoln, Nebraska	219,417	128,220,545
21. **C-TEC Corp.** ** Wilkes-Barre, Pennsylvania	185,338	101,535,473
22. **Anchorage Telephone Utility** Anchorage, Alaska	118,881	83,714,406
23. **Puerto Rico Communications Authority** San Juan, Puerto Rico	114,700	75,880,379
24. **Citizens Utilities Co.** ** Stamford, Connecticut	109,669	139,330,820
25. **North State Telephone Co.** High Point, North Carolina	87,237	42,830,579
26. **Illinois Consolidated Telephone Co.** Mattoon, Illinois	76,719	52,972,542
27. **Concord Telephone Co.** Concord, North Carolina	74,500	27,884,341
28. **Roseville Telephone Co.** * Roseville, California	71,937	58,079,173
29. **North-West Telecommunications, Inc.** ** Tomah, Wisconsin	64,574	34,653,099
30. **Lufkin-Conroe Telephone Exchange** Lufkin, Texas	60,664	54,279,425
31. **Virgin Islands Telephone Corp.** St. Thomas, Virgin Islands	46,378	53,168,000
32. **North Pittsburgh Telephone Co.** Gibsonia, Pennsylvania	43,222	32,859,662
33. **Standard Telephone Co.** Cornelia, Georgia	41,327	29,645,108
34. **Conestoga Telephone & Telegraph Co.** * Birdsboro, Pennsylvania	41,062	21,214,132
35. **Horry Telepone Cooperative, Inc.** Conway, South Carolina	40,630	20,240,185
36. **Telephone Electronics Corp. FAIL, Inc.** Jackson, Mississippi	40,592	26,650,268
37. **Denver and Ephrata Telephone and Telegraph Co.** Ephrata, Pennsylvania	40,177	23,834,310
38. **Farmers Telephone Coop., Inc.** Kingstree, South Carolina	36,495	22,811,958
39. **Pioneer Telephone Coop., Inc.** Kingfisher, Oklahoma	36,114	28,504,967
40. **SLT Communications, Inc.** Sugar Land, Texas	35,755	28,693,718
41. **Guam Telephone Authority** Tamuning, Guam	35,553	22,999,503
42. **Rock Hill Telephone Co.** Rock Hill, South Carolina	34,923	21,803,554
43. **Hargray Telephone Co., Inc.** Hilton Head Island, South Carolina	30,172	22,998,337
44. **Clifton Forge-Waynesboro Telephone Co.** * Staunton, Virginia	28,163	19,085,590
45. **Matanuska Telephone Assn., Inc.** Palmer, Alaska	27,701	31,186,251
46. **Mankato Citizens Telephone Co.** Mankato, Minnesota	27,409	18,566,224
47. **Chillicothe Telephone Co.** Chillicothe, Ohio	26,705	18,545,601
48. **Gulf Telephone Co.** Foley, Alabama	25,100	16,190,635
49. **Great Plains Communications, Inc.** Blair, Nebraska	24,965	16,156,050
50. **Fairbanks Municipal Utilities System** Fairbanks, Alaska	24,704	22,019,108

In Order of Access Lines[1] As of December 31, 1989	Access Lines	Operating Revenues
51. **Lexington Telephone Co.** Lexington, North Carolina	24,455	16,703,933
52. **Twin Lakes Telephone Coop.** Gainesboro, Tennessee	24,276	10,097,259
53. **Ben Lomand Rural Telephone Coop., Inc.** McMinnville, Tennessee	22,755	11,144,201
54. **Northern States Power Co.** • Minot, North Dakota	21,761	10,534,645
55. **Smithville Telephone Co., Inc.** Ellettsville, Indiana	21,745	10,602,597
56. **Wood County Telephone Co.** Wisconsin Rapids, Wisconsin	21,280	9,903,111
57. **East Ascension Telephone Co., Inc.** Gonzales, Louisiana	21,161	15,543,961
58. **St. Joseph Telephone & Telegraph Co.** Port St. Joe, Florida	20,896	17,911,399
59. **Taconic Telephone Corp.** Chatham, New York	20,710	12,490,317
60. **Coastal Utilities, Inc.** Hinesville, Georgia	20,671	17,418,971
61. **Eastex Telephone Coop., Inc.** Henderson, Texas	20,628	15,769,820
62. **Atlantic Telephone Membership Corp.** Shallotte, North Carolina	19,766	8,487,092
63. **South Central Rural Telephone Coop. Corp., Inc.** Glasgow, Kentucky	19,639	11,296,345
64. **San Marcos Telephone Co.** San Marcos, Texas	19,324	16,718,842
65. **Yadkin Valley Telephone Membership Corp.** Yadkinville, North Carolina	18,991	9,373,003
66. **Brandenburg Telephone Co., Inc.** Brandenburg, Kentucky	18,536	9,794,522
67. **Mid-Plains Telephone, Inc.** * Middleton, Wisconsin	18,268	8,745,352
68. **Millington Telephone Co., Inc.** Millington, Tennessee	18,102	9,136,396
69. **Grand River Mutual Telephone Corp.** Princeton, Missouri	17,983	10,256,716
70. **Warwick Valley Telephone Co.** * Warwick, New York	17,719	9,693,591
71. **Ogden Telephone Co.** * Spencerport, New York	17,642	7,555,310
72. **Fort Bend Telephone Co., Inc.** Rosenberg, Texas	17,525	15,002,376
73. **Highland Telephone Coop., Inc.** Sunbright, Tennessee	16,736	8,067,486
74. **Shenandoah Telephone Co.** Edinburg, Virginia	16,671	10,050,300
75. **Ace Telephone Assn.** Houston, Minnesota	16,456	8,675,697
76. **Lancaster Telephone Co.** Lancaster, South Carolina	16,388	9,243,136
77. **Guadalupe Valley Telephone Coop., Inc.** New Braunfels, Texas	15,710	14,226,918
78. **Missouri Telephone Co.** Bolivar, Missouri	15,524	7,624,819
79. **Woodbury Telephone Co.** * Woodbury, Connecticut	15,483	11,068,006
80. **Buffalo Valley Telephone Co.** * Lewisburg, Pennsylvania	15,137	9,566,306
81. **Rhinelander Telephone Co.** * Rhinelander, Wisconsin	14,546	7,326,729
82. **Kerrville Telephone Co.** Kerrville, Texas	14,532	10,896,835
83. **Ellensburg Telephone Co., Inc.** * Ellensburg, Washington	14,435	9,541,054
84. **Farmers Telephone Coop., Inc.** Rainsville, Alabama	14,302	7,658,806
85. **Harrisonville Telephone Co.** Waterloo, Illinois	14,188	8,881,975
86. **North Central Telephone Coop., Inc.** Lafayette, Tennessee	13,807	6,389,348
87. **Arvig Telecom** Pequot Lakes, Minnesota	13,586	9,514,836
88. **Statesboro Telephone Co., Inc.** Statesboro, Georgia	13,573	9,556,569
89. **West Kentucky Rural Telephone Coop. Corp., Inc.** Mayfield, Kentucky	13,559	6,517,498
90. **Home Telephone Co., Inc.** Moncks Corner, South Carolina	13,556	9,108,155
91. **Citizens Telephone Co.** Brevard, North Carolina	13,530	7,993,755
92. **Craw-Kan Telephone Coop., Inc.** Girard, Kansas	13,353	8,032,288
93. **Sierra Telephone Co., Inc.** Oakhurst, California	13,183	19,255,761
94. **East Otter Tail Telephone Co.** Perham, Minnesota	13,119	7,983,991
95. **DeKalb Telephone Coop., Inc.** Alexandria, Tennessee	13,069	7,364,255
96. **Garden Valley Telephone Co.** Erskine, Minnesota	12,911	7,606,360
97. **UTELCO, Inc.** Monroe, Wisconsin	12,782	7,289,195
98. **Chester Telephone Co.** Chester, South Carolina	12,341	6,658,038
99. **Star Telephone Membership Corp.** Clinton, North Carolina	12,196	5,408,302
100. **Southland Telephone Co.** Atmore, Alabama	11,973	8,231,010
101. **Souris River Telephone Mutual Aid Coop.** Minot, North Dakota	11,413	7,789,032
102. **LaFourche Telephone Co., Inc.** LaRose, Louisiana	11,353	13,905,710
103. **Pioneer Telephone Association, Inc.** Ulysses, Kansas	11,332	9,327,593

In Order of Access Lines[1] As of December 31, 1989	Access Lines	Operating Revenues
104. **Golden West Telecommunications Coop., Inc.** Wall, South Dakota	10,985	7,591,252
105. **Camden Telephone Co.** St. Marys, Georgia	10,942	7,535,257
106. **New Ulm Telecommunications, Inc.** New Ulm, Minnesota	10,551	5,456,987
107. **Foothills Rural Telephone Coop. Corp., Inc.** Staffordsville, Kentucky	10,533	4,697,667
108. **Monroeville Telephone Co.** Monroeville, Alabama	10,327	7,896,475
109. **Pioneer Telephone Coop.** Philomath, Oregon	10,258	5,170,613
110. **Mountain Rural Telephone Coop. Corp., Inc.** West Liberty, Kentucky	10,094	5,364,670
111. **Brookings Municipal Telephone Company** Brookings, South Dakota	10,065	4,699,261
112. **Fidelity Telepone Co.** Sullivan, Missouri	9,981	7,809,000
113. **Sandhill Telephone Coop., Inc.** Jefferson, South Carolina	9,928	5,113,976
114. **ENMR Telephone Coop.** Clovis, New Mexico	9,858	17,894,568
115. **Fort Mill Telephone Co.** Fort Mill, South Carolina	9,774	5,498,500
116. **Surry Telephone Membership Corp.** Dobson, North Carolina	9,625	4,330,530
117. **The North-Eastern Pennsylvania Telephone Co.** Forest City, Pennsylvania	9,573	5,777,790
118. **Lakedale Telephone Co.** Annandale, Minnesota	9,490	4,820,451
119. **Chautauqua & Erie Telephone Co.** Westfield, New York	9,390	5,750,618
120. **Brindlee Mountain Telephone Co.** Arab, Alabama	9,336	5,737,570
121. **Interstate Telephone Co., Inc.** West Point, Georgia	9,257	5,779,451
122. **Etex Telephone Coop., Inc.** Gilmer, Texas	9,026	5,763,461
123. **Champaign Telephone Co.** Urbana, Ohio	9,019	6,993,092
124. **Piedmont Rural Telephone Coop., Inc.** Laurens, South Carolina	9,010	5,275,164
125. **Palmetto Rural Telephone Coop., Inc.** Walterboro, South Carolina	8,991	4,978,065
126. **Hill Country Telephone Coop.** Ingram, Texas	8,927	9,087,163
127. **Palmerton Telephone Co.** Palmerton, Pennsylvania	8,926	6,339,550
128. **Wilkes Telephone & Electric Co.** Washington, Georgia	8,822	4,003,610
129. **Churchill County Telephone** Fallon, Nevada	8,713	6,187,952
130. **Community Service Telephone Co.** Winthrop, Maine	8,677	4,592,511
131. **Polar Communications Mutual Aid Corp.** Park River, North Dakota	8,668	4,288,547
132. **West River Mutual Aid Telephone Corp.** Hazen, North Dakota	8,607	3,908,122
133. **Duo County Telephone Coop. Corp., Inc.** Jamestown, Kentucky	8,567	4,497,699
134. **Scott-Rice Telephone Company** Prior Lake, Minnesota	8,455	4,753,692
135. **West Carolina Rural Telephone Coop., Inc.** Abbeville, South Carolina	8,311	3,955,849
136. **Clay County Rural Telephone Coop., Inc.** Cloverdale, Indiana	8,273	4,601,886
137. **Evans Telephone Co.** Turlock, California	8,236	9,846,861
138. **Pineland Telephone Coop., Inc.** Metter, Georgia	8,154	4,922,538
139. **Interstate Teleommunications Coop., Inc.** Clear Lake, South Dakota	8,017	4,167,475
140. **Ringgold Telephone Co.** Ringgold, Georgia	7,925	5,185,568
141. **Pond Branch Telephone Co., Inc.** Gilbert, South Carolina	7,883	4,775,834
142. **Three Rivers Telephone Coop., Inc.** Fairfield, Montana	7,766	6,186,927
143. **Triangle Telephone Coop. Assn., Inc.** Havre, Montana	7,742	6,475,668
144. **Melrose Telephone Co.** Melrose, Minnesota	7,736	4,814,030
145. **Volcano Telephone Co.** Pine Grove, California	7,728	10,158,812
146. **Public Service Telephone Co.** Reynolds, Georgia	7,716	7,314,420
147. **Telephone Service Company** Wapakoneta, Ohio	7,690	4,390,276
148. **Hutchinson Telephone Co.** Hutchinson, Minnesota	7,469	4,991,492
149. **Gulf Telephone Co.** Perry, Florida	7,449	3,909,758
150. **Wilkes Telephone Membership Corp.** Millers Creek, North Carolina	7,364	3,751,046

---

[1] For year end 1989, USTA requested the reporting companies not include official communications or test lines in their calculation of total access lines.

• Company or parent listed on New York Stock Exchange
† Company or parent listed on American Stock Exchange
* Over-the-counter Market
** Company or parent listed on NASDAQ

Reprinted with permission from USTA.

Table 12

Selected Finincial Information of the Top Four Independent Telephone Companies
As of December 31, 1989

	GTE	United	Contel	Centel	*Other Independants	Total
Revenue: $ millions	17,424	7,549	3,114	1,188	10,270	39,545
Expenses and Income Taxes: $ millions	16,007	7,186	2,827	743	9,575	36,338
Net Income: $ millions	1,417	363	287	445	695	3,207
Earnings per Share: $	4.16	1.72	1.74	5.11	N/A	N/A
Dividends per Share: $	2.80	3.00	1.09	1.50	N/A	N/A
Average Shares Outstanding: millions	330	209	1.59	84	N/A	N/A
Total Assets: $ millions	31,986	9,821	5,846	3,417	N/A	N/A
Long Term Debt: $ millions	11,185	3,747	1,978	1,414	N/A	N/A
Customer Access Lines: thousands	15.1	3.8	2.6	1.6	10.1	33.2
Number of Employees: thousands	158.0	40.0	21.8	12.5	76.7	309.0

* Estimated by the NATA Market Research Department

Source: Induvidual Annual and 10K Company Reports

Table 13

OUTSIDE PLANT STATISTICS BY STATE AS OF DECEMBER 31, 1988

STATE	MILES OF AERIAL WIRE	AERIAL CABLE		UNDERGROUND CABLE		BURIED CABLE		SUBMARINE CABLE	
		MILES OF CABLE	MILES OF WIRE IN CABLE	MILES OF CABLE	MILES OF WIRE IN CABLE	MILES OF CABLE	MILES OF WIRE IN CABLE	MILES OF CABLE	MILES OF WIRE IN CABLE
ALABAMA	20,340	26,799	6,510,631	3,883	7,534,275	37,804	8,990,650	27	29,545
ALASKA	0	809	211,467	245	373,751	766	520,196	281	281
ARIZONA	13,131	8,767	1,693,144	5,030	12,956,644	25,395	9,462,723	2	111
ARKANSAS	12,141	6,970	1,833,158	1,529	2,967,583	32,311	6,011,251	19	8,424
CALIFORNIA	67,258	110,699	35,271,747	67,428	126,097,449	77,067	19,810,956	205	165,755
COLORADO	25,144	9,413	1,761,658	6,062	13,928,819	33,969	7,310,299	5	3,271
CONNECTICUT	60	27,811	9,547,146	5,398	10,199,617	4,004	1,033,524	34	35,690
DELAWARE	0	2,433	968,125	887	1,964,745	5,822	1,519,394	5	3,569
DIST. OF COLUMBIA	0	696	376,729	1,839	5,121,889	58	19,684	16	36,579
FLORIDA	11,807	35,996	8,709,488	18,900	40,951,458	114,018	37,995,002	197	294,357
GEORGIA	59,001	37,048	9,768,448	9,226	16,348,521	64,735	13,902,200	23	8,808
HAWAII	8,957	6,653	1,835,110	2,032	1,502,213	406	58,454	3	903
IDAHO	3,674	3,115	547,399	898	1,785,798	21,054	3,134,198	115	7,768
ILLINOIS	10,027	27,639	6,648,224	18,836	38,771,844	93,545	14,663,815	24	16,635
INDIANA	17,438	26,328	5,994,350	7,351	12,472,032	51,201	8,066,011	13	11,481
IOWA	425	3,643	707,316	2,992	5,199,207	54,498	6,992,122	29	20,821
KANSAS	2,604	5,192	1,339,896	2,670	5,051,928	35,070	6,111,094	7	1,368
KENTUCKY	30,634	34,131	7,920,392	3,617	6,372,058	20,767	4,034,671	7	1,238
LOUISIANA	3,517	14,420	4,819,625	5,701	11,959,696	45,216	11,588,334	111	141,089
MAINE	17,051	21,663	4,611,511	907	1,436,323	1,677	468,672	85	32,720
MARYLAND	0	24,665	12,116,578	4,899	11,971,992	19,743	6,331,384	53	50,661
MASSACHUSETTS	8,291	43,739	14,937,966	12,265	22,167,471	6,019	2,055,785	49	68,233
MICHIGAN	12,531	37,826	10,792,770	14,628	29,783,348	98,092	18,824,634	48	44,947
MINNESOTA	3,232	5,968	1,163,214	5,969	11,944,197	60,041	10,667,416	59	44,528
MISSISSIPPI	13,779	21,938	5,736,972	1,799	3,328,745	38,409	5,960,331	26	22,978
MISSOURI	11,932	27,921	5,501,506	5,975	12,471,572	87,821	11,088,417	35	9,573
MONTANA	7,455	2,965	526,138	623	1,056,604	21,036	1,981,925	3	5,127
NEBRASKA	794	1,991	642,290	1,767	3,453,891	48,182	4,700,218	9	3,146
NEVADA	12,977	4,634	1,388,963	3,053	4,176,331	5,987	1,278,196	1	52
NEW HAMPSHIRE	7,542	17,393	4,645,063	1,224	2,398,755	2,559	823,227	33	14,854
NEW JERSEY	0	33,265	19,243,223	13,156	29,405,889	8,962	3,458,970	79	129,264
NEW MEXICO	4,869	5,790	1,103,473	1,396	2,845,288	14,686	3,110,943	2	106
NEW YORK	65,827	73,642	26,488,670	28,997	63,883,391	39,311	10,023,572	483	148,175
NORTH CAROLINA	29,250	30,139	9,373,019	6,591	10,526,297	86,615	16,359,715	42	29,231
NORTH DAKOTA	184	528	110,314	440	972,390	32,916	2,658,511	1	988
OHIO	29,988	69,021	17,909,561	15,013	24,764,501	60,859	9,376,748	42	22,146
OKLAHOMA	11,889	8,590	2,256,914	3,456	7,532,837	53,366	9,863,596	54	15,873
OREGON	33,252	14,583	2,602,806	3,823	7,458,580	20,835	4,145,367	27	25,336
PENNSYLVANIA	15,643	76,787	24,373,031	12,956	27,200,734	22,201	4,241,457	12	7,529
RHODE ISLAND	2,678	6,955	2,438,567	1,598	3,210,152	608	274,979	13	5,776
SOUTH CAROLINA	9,322	10,484	3,352,929	3,683	5,858,120	35,229	8,189,161	6	4,870
SOUTH DAKOTA	438	658	97,722	621	1,094,277	33,673	2,507,053	7	1,025
TENNESSEE	42,301	38,031	8,928,164	4,951	10,343,075	36,525	9,561,733	12	21,236
TEXAS	69,186	61,036	17,631,073	23,090	55,759,386	176,575	41,687,751	84	48,468
UTAH	4,226	4,125	781,653	1,989	3,957,404	10,908	3,919,085	1	112
VERMONT	12,544	11,780	2,206,562	396	623,258	1,598	485,452	18	6,261
VIRGINIA	19,228	41,843	11,346,449	6,152	14,985,862	62,839	13,990,498	20	14,932
WASHINGTON	33,483	15,611	3,648,576	7,222	14,829,820	34,669	7,958,755	176	75,047
WEST VIRGINIA	1,998	22,749	6,392,292	938	1,779,997	10,669	1,498,878	10	14,490
WISCONSIN	13,441	14,504	3,742,451	5,166	9,982,581	53,735	9,173,283	167	40,384
WYOMING	1,841	1,178	222,981	492	997,868	16,075	2,270,257	3	225
UNITED STATES	783,327	1,140,564	332,777,452	359,758	723,760,462	1,920,125	390,160,548	2,784	1,695,986
PUERTO RICO	19,918	9,822	4,240,770	1,361	2,893,017	2,076	796,746	0	0
VIRGIN ISLANDS	0	0	0	1	732	4	3,081	0	0
OCEAN CABLE	0	0	0	0	0	0	0	0	0
GRAND TOTAL	803,245	1,150,386	337,018,222	361,120	726,654,211	1,922,205	390,960,374	2,784	1,695,986

OUTSIDE PLANT STATISTICS BY STATE AS OF DECEMBER 31, 1988—CONTINUED

STATE	DEEP SEA CABLE		INTRABUILDING NETWORK CABLE		TOTAL CABLE		MILES OF FIBER IN CABLE	
	MILES OF CABLE	MILES OF WIRE IN CABLE	MILES OF CABLE	MILES OF WIRE IN CABLE	MILES OF CABLE	MILES OF WIRE IN CABLE	FIBER MILES EQUIPPED WITH ELECTRONICS (LIT)	TOTAL FIBER MILES DEPLOYED (LIT AND DARK)
ALABAMA	0	0	419	128,549	68,932	23,193,650	10,936	28,214
ALASKA	0	0	0	0	2,100	1,105,694	344	2,003
ARIZONA	0	0	614	274,179	39,808	24,386,801	14,908	30,162
ARKANSAS	0	0	262	77,757	41,091	10,898,173	2,970	16,178
CALIFORNIA	0	0	13,823	4,466,809	269,223	185,812,717	52,044	186,507
COLORADO	0	0	1,351	533,593	50,800	23,537,640	12,182	36,591
CONNECTICUT	0	0	1,695	721,906	38,942	21,537,883	9,296	12,070
DELAWARE	0	0	330	116,600	9,477	4,572,433	2,708	12,134
DIST. OF COLUMBIA	0	0	978	664,075	3,587	6,218,956	1,928	11,786
FLORIDA	0	0	1,242	490,166	170,354	88,440,470	72,580	159,691
GEORGIA	0	0	782	312,551	111,814	40,340,528	57,423	107,959
HAWAII	0	0	244	55,817	9,338	3,452,497	0	1,783
IDAHO	0	0	140	31,576	25,322	5,506,739	1,339	4,125
ILLINOIS	0	0	6,947	2,034,005	146,991	62,134,523	80,791	101,368
INDIANA	0	0	1,378	416,172	86,271	26,960,046	21,852	54,729
IOWA	0	0	203	61,802	61,365	12,981,268	7,802	31,262
KANSAS	0	0	158	42,851	43,098	12,547,137	8,224	36,803
KENTUCKY	0	0	460	108,265	58,982	18,436,624	8,278	25,985
LOUISIANA	0	0	967	314,155	66,415	28,822,899	19,647	44,639
MAINE	0	0	0	0	24,332	6,549,226	655	1,933
MARYLAND	0	0	1,916	728,844	51,276	31,199,459	13,806	57,732
MASSACHUSETTS	0	0	0	0	62,072	39,229,455	9,523	12,723
MICHIGAN	0	0	3,847	1,181,231	154,441	60,626,930	20,176	73,270
MINNESOTA	0	0	441	208,738	72,478	24,028,093	10,144	32,250
MISSISSIPPI	0	0	382	107,700	62,554	15,156,726	14,965	40,001
MISSOURI	0	0	809	264,756	122,560	29,335,824	16,060	61,449
MONTANA	0	0	162	25,874	24,789	3,595,668	586	1,673
NEBRASKA	0	0	309	86,254	52,257	8,885,798	9,008	29,544
NEVADA	0	0	291	76,071	13,967	6,919,614	5,189	19,861
NEW HAMPSHIRE	0	0	0	0	21,209	7,881,899	2,103	4,431
NEW JERSEY	0	0	200	159,224	55,662	52,396,570	10,410	23,847
NEW MEXICO	0	0	265	78,654	22,139	7,138,464	8,432	16,722
NEW YORK	0	0	13,448	5,915,288	155,881	106,459,096	13,796	187,465
NORTH CAROLINA	0	0	579	171,631	123,966	36,459,893	30,266	84,480
NORTH DAKOTA	0	0	188	41,716	34,073	3,783,919	2,449	6,997
OHIO	0	0	3,907	1,024,397	148,842	53,097,353	30,401	67,474
OKLAHOMA	0	0	636	236,905	66,102	19,906,125	8,567	32,033
OREGON	0	0	543	157,119	39,811	14,389,208	4,720	19,449
PENNSYLVANIA	0	0	5,911	1,837,658	117,867	57,660,410	17,055	118,905
RHODE ISLAND	0	0	0	0	9,174	5,929,474	358	590
SOUTH CAROLINA	0	0	847	261,678	50,249	17,666,758	24,111	52,378
SOUTH DAKOTA	0	0	214	50,692	35,173	3,750,769	2,341	6,689
TENNESSEE	0	0	674	244,101	80,194	29,098,308	7,110	21,414
TEXAS	0	0	3,041	1,259,693	263,826	116,386,370	46,037	176,864
UTAH	0	0	302	120,751	17,325	8,779,005	3,699	13,816
VERMONT	0	0	0	0	13,792	3,321,533	202	415
VIRGINIA	0	0	1,498	769,634	112,352	41,107,375	14,112	96,187
WASHINGTON	0	0	1,882	636,280	59,560	27,148,478	11,639	43,064
WEST VIRGINIA	0	0	399	108,611	34,765	9,794,268	2,233	23,873
WISCONSIN	0	0	1,059	377,566	74,631	23,316,265	8,415	31,321
WYOMING	0	0	91	21,141	17,839	3,512,472	4,003	16,406
UNITED STATES	0	0	75,835	27,003,034	3,499,067	1,475,397,483	737,824	2,279,244
PUERTO RICO	0	0	1	126	13,259	7,930,657	2,802	3,538
VIRGIN ISLANDS	0	0	0	0	5	3,813	0	0
OCEAN CABLE	23,216	151,003	0	0	23,216	151,003	7,440	7,440
GRAND TOTAL	23,216	151,003	75,836	27,003,160	3,535,547	1,483,482,956	748,066	2,290,222

OUTSIDE PLANT STATISTICS BY STATE AS OF DECEMBER 31, 1988—CONTINUED

STATE	NUMBER OF POLES	EQUIPPED MILES OF TUBE IN COAXIAL CABLE	CONDUIT SYSTEM		RADIO RELAY SYSTEM		
			TRENCH MILES	DUCT MILES	MILES OF SYSTEM	MILES OF RADIO CHANNEL	MILES OF EQUIVALENT 4KHZ TELEPHONE CHANNEL
ALABAMA	432,777	57	1,236	9,569	4,991	53,191	19,515,901
ALASKA	1,534	299	131	821	8,403	2,300,932	13,572,689
ARIZONA	154,733	4,857	1,827	11,261	4,439	34,322	31,271,463
ARKANSAS	167,195	2	514	4,126	3,148	23,441	14,607,150
CALIFORNIA	1,811,801	19,740	20,649	125,477	14,798	149,956	66,481,607
COLORADO	219,892	5,258	2,298	13,422	6,151	50,396	36,653,740
CONNECTICUT	386,378	4,621	1,642	10,993	1,271	10,218	3,075,314
DELAWARE	45,669	411	386	2,830	151	1,703	693,532
DIST. OF COLUMBIA	17,461	56	588	3,993	21	238	64,461
FLORIDA	636,570	10,232	10,301	51,530	5,951	1,959,679	9,478,598
GEORGIA	427,051	8,783	2,819	23,433	3,894	48,034	22,701,222
HAWAII	138,533	403	546	1,503	4,594	1,253,782	1,253,782
IDAHO	62,167	41	385	2,433	3,533	18,430	9,978,345
ILLINOIS	708,979	15,506	6,080	41,713	5,287	55,476	28,518,742
INDIANA	535,664	12,129	3,382	17,247	3,749	201,557	18,487,144
IOWA	116,194	8,184	1,114	5,600	4,066	34,622	25,524,651
KANSAS	168,973	5,419	715	5,560	4,030	44,453	26,746,364
KENTUCKY	440,056	1,362	1,239	9,145	3,665	230,875	12,963,826
LOUISIANA	284,402	443	1,832	13,674	2,660	23,153	11,147,499
MAINE	231,984	61	454	2,249	1,335	6,015	1,603,742
MARYLAND	341,743	4,742	1,641	14,098	1,627	17,931	6,882,564
MASSACHUSETTS	639,227	4,926	5,123	29,643	1,112	9,576	1,883,294
MICHIGAN	672,585	1,624	5,053	33,006	3,737	23,423	12,156,215
MINNESOTA	154,213	973	2,102	12,713	4,970	41,614	19,492,421
MISSISSIPPI	259,710	1,469	481	3,918	3,423	31,239	16,361,052
MISSOURI	552,605	3,846	2,151	13,949	6,507	55,699	30,271,092
MONTANA	58,701	34	180	1,022	2,194	4,729	3,377,752
NEBRASKA	60,987	10,985	636	4,103	8,592	18,296	13,787,493
NEVADA	84,722	7,874	2,860	5,541	5,065	35,622	17,682,161
NEW HAMPSHIRE	211,673	59	524	3,316	621	4,412	1,441,402
NEW JERSEY	649,187	9,767	4,792	34,783	2,249	26,512	6,927,544
NEW MEXICO	86,021	5,304	608	3,066	4,368	36,706	32,033,167
NEW YORK	1,298,988	14,058	11,173	46,692	6,228	3,359,921	59,510,761
NORTH CAROLINA	475,120	5,764	1,983	14,923	5,772	569,185	14,318,944
NORTH DAKOTA	15,251	7	147	915	2,239	15,810	9,244,654
OHIO	1,228,735	22,606	5,184	33,481	5,062	725,937	18,589,780
OKLAHOMA	287,846	499	1,084	8,080	4,278	47,848	32,244,428
OREGON	169,429	2,002	1,573	7,632	5,950	40,282	17,224,708
PENNSYLVANIA	1,273,450	12,141	5,185	34,606	6,586	75,324	29,388,214
RHODE ISLAND	130,501	487	624	4,062	71	233	69,523
SOUTH CAROLINA	173,960	2,908	1,293	11,276	2,727	33,168	12,491,753
SOUTH DAKOTA	20,328	332	316	1,428	1,857	8,141	4,865,217
TENNESSEE	528,419	71	1,785	12,141	3,200	49,009	16,498,725
TEXAS	1,304,961	3,572	8,228	60,451	9,033	105,880	52,361,335
UTAH	89,391	5,039	715	4,141	3,620	32,742	18,326,958
VERMONT	142,409	25	294	1,321	458	3,601	1,200,457
VIRGINIA	548,241	8,001	2,634	15,227	4,153	151,355	17,294,691
WASHINGTON	308,404	753	3,006	14,265	4,927	32,374	10,891,821
WEST VIRGINIA	303,673	2,973	398	2,696	1,956	70,179	6,818,579
WISCONSIN	239,947	1,088	1,972	10,809	4,676	32,956	24,239,257
WYOMING	38,189	10,288	273	1,459	4,633	26,798	21,932,606
UNITED STATES	19,336,629	242,081	132,156	801,341	208,028	12,186,974	884,148,341
PUERTO RICO	196,918	101	0	2,297	280	83,161	0
VIRGIN ISLANDS	0	0	0	3	150	0	0
OCEAN CABLE	0	21,777	0	0	0	0	0
GRAND TOTAL	19,533,547	263,959	132,156	803,642	208,458	12,270,134	884,148,341

Source: FCC

Table 14

ACCESS LINES BY TYPE OF TECHNOLOGY BY STATE AS OF DECEMBER 31, 1988

STATE	NUMBER OF CENTRAL OFFICE SWITCHES	ISDN 16 KB/SEC D CHANNELS (DIV. BY 4)	MAIN DIGITAL ACCESS LINES 64KB/S OR EQUIV. (ISDN B CHANNELS EXC. TO PBX'S)	MAIN ANALOG ACCESS LINES 4KHZ OR EQUIVALENT	DIGITAL DS-1 ACCESS LINES TO PBX'S AND CENTREX (TIMES 24)	ANALOG PBX AND CENTREX ACCESS TRUNKS	ANALOG CENTREX EXTENSIONS	OTHER
ALABAMA	235	0	0	1,438,688	0	40,077	25,574	30,267
ALASKA	10	0	0	113,569	17	1,858	0	0
ARIZONA	170	0	289,908	1,291,543	8,542	91,917	0	957
ARKANSAS	194	0	0	718,561	46	18,399	5,932	13,693
CALIFORNIA	1,055	0	2,011,613	12,453,593	74,876	606,082	758,643	40,718
COLORADO	211	64	539,518	1,102,017	16,113	86,264	0	1,146
CONNECTICUT	153	21	160	1,671,091	25,824	67,806	87,018	50,604
DELAWARE	34	0	0	377,549	0	11,797	0	0
DIST. OF COLUMBIA	31	115	460	751,701	168	51,183	0	0
FLORIDA	441	0	0	6,568,319	0	188,338	87,227	33,293
GEORGIA	411	0	0	2,535,959	0	104,301	78,794	48,240
HAWAII	82	0	330,480	168,157	1,056	4,189	948	26,419
IDAHO	116	0	72,174	320,657	4,492	19,367	0	404
ILLINOIS	804	446	0	5,086,287	801	211,770	405,967	786
INDIANA	392	0	528	2,079,791	1,536	189,721	333	1,188
IOWA	326	0	112,678	843,153	3,134	66,420	0	839
KANSAS	187	0	0	923,571	0	31,573	9,041	24,466
KENTUCKY	403	0	0	1,273,249	0	31,511	11,187	14,770
LOUISIANA	229	0	0	1,635,566	0	51,339	50,122	9,675
MAINE	140	0	0	515,135	25	10,570	13,545	0
MARYLAND	227	9	35	2,545,586	672	92,940	0	0
MASSACHUSETTS	290	285	1,182	3,240,893	66	144,867	150,516	0
MICHIGAN	608	0	0	4,092,670	0	135,074	276,257	1,579
MINNESOTA	250	97	264,221	1,281,205	46,282	170,311	0	1,122
MISSISSIPPI	200	0	0	879,963	0	18,676	13,188	14,561
MISSOURI	507	0	0	1,865,499	105,144	73,792	23,391	39,647
MONTANA	135	0	120,747	173,565	4,555	5,767	0	273
NEBRASKA	286	8	114,257	515,208	4,909	41,594	13,515	230
NEVADA	79	0	367,537	198,968	11,193	5,926	15,065	0
NEW HAMPSHIRE	121	0	0	542,368	7	15,029	17,651	0
NEW JERSEY	212	5	20	4,509,011	144	134,133	0	0
NEW MEXICO	79	0	104,356	442,137	13,106	24,758	0	156
NEW YORK	855	0	143,507	8,944,110	7,680	410,009	529,582	0
NORTH CAROLINA	418	0	0	2,407,542	4,068	63,497	55,667	34,642
NORTH DAKOTA	106	0	48,949	179,595	2,511	18,748	0	181
OHIO	821	0	85	4,492,327	1,608	154,418	163,546	222
OKLAHOMA	277	0	0	1,229,777	162	38,735	11,395	30,868
OREGON	152	16	258,526	867,889	17,804	69,008	0	148
PENNSYLVANIA	589	0	171,475	5,341,859	144	167,481	2,844	563
RHODE ISLAND	33	0	0	502,083	5	14,723	8,154	0
SOUTH CAROLINA	219	0	0	1,070,580	0	29,388	27,512	6,527
SOUTH DAKOTA	107	0	24,964	206,263	548	15,728	0	9
TENNESSEE	248	0	141,132	1,836,582	3,062	60,487	31,995	30,961
TEXAS	1,098	0	0	6,803,190	7,426	303,296	143,519	116,062
UTAH	99	0	141,735	482,305	10,540	37,626	0	330
VERMONT	92	0	0	243,319	2	5,586	5,849	0
VIRGINIA	453	14	50,852	2,911,262	6,963	99,970	35	0
WASHINGTON	224	0	711,505	1,301,222	69,153	116,342	7,164	594
WEST VIRGINIA	208	7	27	709,560	0	12,781	0	0
WISCONSIN	334	0	1,592	1,792,871	0	58,167	117,624	364
WYOMING	58	0	1,203	194,507	23	15,008	0	593
UNITED STATES	15,009	1,087	6,025,426	103,672,072	454,407	4,438,347	3,148,800	577,097
PUERTO RICO	86	0	0	765,596	0	0	0	0
GRAND TOTAL	15,095	1,087	6,025,426	104,437,668	454,407	4,438,347	3,148,800	577,097

NOTE -- THIS TABLE INCLUDES DATA OF REPORTING LOCAL EXCHANGE CARRIERS PLUS ALASCOM.

-- SEE TABLE 2.10 FOR DATA OF INDIVIDUAL CARRIERS.

-- BELL ATLANTIC DOES NOT COUNT D CHANNELS AS ACCESS LINES.

-- CENTRAL TELEPHONE COMPANY AND CENTRAL TELEPHONE COMPANY OF VIRGINIA INCLUDED SPECIAL ACCESS LINES WITH SWITCHED ACCESS LINES BY TECHNOLOGY, 8,219 AND 2,968 RESPECTIVELY. WE EXCLUDED THEM FROM MAIN ACCESS LINES.

-- PUERTO RICO TELEPHONE COMPANY AND ROCHESTER TELEPHONE CORPORATION WERE NOT ABLE TO PROVIDE ACCESS LINES BY TECHNOLOGY. WE INCLUDED ALL SWITCHED ACCESS LINES (765,596 AND 416,900 RESPECTIVELY) WITH MAIN ANALOG ACCESS LINES.

-- CAROLINA TELEPHONE AND TELEGRAPH COMPANY INCLUDED SPECIAL ACCESS LINES WITH SWITCHED ACCESS LINES IN THEIR SCHEDULE SHOWING ACCESS LINES BY TECHNOLOGY. WE EXCLUDED THE SPECIAL ACCESS LINES (70,124) FROM MAIN ANALOG ACCESS LINES.

Source: FCC

Table 15

ACCESS LINES BY TYPE OF CUSTOMER BY STATE AS OF DECEMBER 31, 1988

STATE	BUSINESS ACCESS LINES		PUBLIC ACCESS LINES	RESIDENTIAL ACCESS LINES	MOBILE ACCESS LINES	SPECIAL ACCESS LINES (NON-SWITCHED)	TOTAL ACCESS LINES (SWITCHED AND SPECIAL)
	SINGLE-LINE	MULTI-LINE					
ALABAMA	43,156	285,411	20,100	1,185,599	340	23,612	1,558,218
ALASKA	17,201	22,960	1,896	73,387	0	378	115,822
ARIZONA	321,097	100,392	22,254	1,238,091	1,033	96,194	1,779,061
ARKANSAS	31,268	121,459	13,323	590,901	410	2,677	760,036
CALIFORNIA	3,371,141	1,679,460	195,020	10,697,887	2,017	1,106,565	17,052,090
COLORADO	374,480	102,377	24,450	1,242,669	1,146	112,097	1,857,219
CONNECTICUT	61,801	501,941	26,055	1,312,691	36	350	1,902,874
DELAWARE	54,412	68,534	5,085	261,061	254	8,853	398,199
DISTRICT OF COLUMBIA	123,709	388,306	10,719	280,662	116	25,166	828,678
FLORIDA	359,808	1,300,670	77,513	5,136,503	2,683	141,931	7,019,108
GEORGIA	102,172	687,723	34,478	1,942,692	229	78,750	2,846,044
HAWAII	95,614	52,968	6,945	375,238	484	7,340	538,589
IDAHO	69,335	29,283	4,545	313,518	413	15,985	433,079
ILLINOIS	982,495	727,469	85,982	3,909,535	576	106,288	5,812,345
INDIANA	291,279	226,559	33,296	1,721,707	256	40,511	2,313,608
IOWA	155,878	72,607	11,172	786,380	195	17,650	1,043,882
KANSAS	35,802	199,080	15,749	737,597	630	8,876	997,734
KENTUCKY	50,701	212,883	17,764	1,048,883	486	23,561	1,354,278
LOUISIANA	48,366	346,072	23,215	1,328,395	654	24,478	1,771,180
MAINE	119,352	0	6,812	413,111	0	3,979	543,254
MARYLAND	438,672	361,458	38,046	1,800,891	166	80,783	2,720,016
MASSACHUSETTS	1,011,271	0	56,354	2,470,184	0	44,206	3,582,015
MICHIGAN	694,802	494,550	61,677	3,253,098	1,453	54,852	4,560,432
MINNESOTA	255,985	223,633	15,974	1,267,549	105	29,273	1,792,519
MISSISSIPPI	35,255	154,109	14,372	722,556	96	10,518	936,906
MISSOURI	95,180	367,244	36,109	1,608,389	547	20,800	2,128,269
MONTANA	57,439	10,677	4,867	231,651	273	14,046	318,953
NEBRASKA	95,281	70,728	8,694	514,304	579	14,755	704,341
NEVADA	74,851	86,304	9,466	427,257	801	14,437	613,116
NEW HAMPSHIRE	147,552	0	8,199	419,304	0	6,585	581,640
NEW JERSEY	623,682	481,755	84,255	3,183,299	317	135,040	4,778,348
NEW MEXICO	101,520	42,869	7,630	432,338	156	27,850	612,363
NEW YORK	2,042,196	1,026,517	127,251	6,837,454	1,470	246,530	10,281,418
NORTH CAROLINA	167,297	393,518	29,219	1,974,819	563	115,997	2,681,413
NORTH DAKOTA	38,974	21,259	3,142	186,428	181	3,558	253,542
OHIO	599,332	515,805	66,128	3,630,470	471	93,796	4,906,002
OKLAHOMA	52,217	250,802	22,020	983,698	1,386	2,824	1,312,947
OREGON	179,423	124,612	13,830	894,821	705	12,185	1,225,576
PENNSYLVANIA	874,085	686,202	76,804	4,045,678	1,597	102,085	5,786,451
RHODE ISLAND	117,289	0	7,501	400,175	0	5,342	530,307
SOUTH CAROLINA	47,236	209,635	16,905	860,195	36	22,074	1,156,081
SOUTH DAKOTA	39,126	16,276	3,620	188,481	9	3,251	250,763
TENNESSEE	68,801	415,052	22,752	1,597,030	584	37,474	2,141,693
TEXAS	259,696	1,708,499	102,176	5,298,842	4,280	45,339	7,418,832
UTAH	122,517	48,166	8,582	492,941	330	35,992	708,528
VERMONT	61,882	0	3,987	188,887	0	2,850	257,606
VIRGINIA	471,522	419,341	42,930	2,134,925	364	81,002	3,150,084
WASHINGTON	322,381	256,784	20,571	1,605,160	1,084	18,887	2,224,867
WEST VIRGINIA	93,829	51,209	10,880	566,408	42	25,485	747,853
WISCONSIN	451,409	23,349	27,316	1,468,315	229	18,138	1,988,756
WYOMING	43,215	15,031	3,723	148,772	593	18,716	230,050
UNITED STATES	16,662,984	15,601,538	1,591,353	84,430,826	30,375	3,189,911	121,506,987
PUERTO RICO	131,742	26,725	14,293	584,136	8,700	2,771	768,367
GRAND TOTAL	16,794,726	15,628,263	1,605,646	85,014,962	39,075	3,192,682	122,275,354

NOTE -- THIS TABLE INCLUDES DATA OF REPORTING LOCAL EXCHANGE CARRIERS PLUS ALASCOM.
-- SEE TABLE 2.[illegible] FOR DATA OF INDIVIDUAL CARRIERS.
-- NEW ENGLAND TELEPHONE COMPANY WAS UNABLE TO SEPARATE BUSINESS ACCESS LINES BETWEEN SINGLE AND MULTI-LINE.
-- SOUTHERN NEW ENGLAND TELEPHONE COMPANY EXCLUDED 25,824 DIGITAL DS-1 ACCESS LINES TO PBX'S AND CENTREX'S FROM THEIR TOTAL ACCESS LINES (SWITCHED AND SPECIAL). WE INCLUDED THEM IN THE BUSINESS MULTI-LINE CATEGORY.

Source: FCC

Table 16

TELEPHONE CALLS AND MINUTES BY STATE AS OF DECEMBER 31, 1988
(FIGURES SHOWN IN THOUSANDS)

STATE	TOTAL LOCAL CALLS	INTRALATA TOLL CALLS	INTERLATA TOLL CALLS (COMPLETED)					
			INTERSTATE		INTRASTATE		TOTAL INTERLATA TOLL CALLS	
			NUMBER	BILLED MINUTES	NUMBER	BILLED MINUTES	NUMBER	BILLED MINUTES
ALABAMA	6,361,185	125,731	263,597	2,959,289	87,114	955,019	350,712	3,914,308
ALASKA	536,201	41,772	50,253	586,028	54,086	229,617	104,338	815,646
ARIZONA	5,970,880	94,450	957,996	4,532,032	126,466	598,245	1,084,462	5,130,277
ARKANSAS	2,440,747	101,453	216,864	1,573,708	50,718	380,506	267,582	1,954,214
CALIFORNIA	48,881,775	5,371,672	1,985,578	20,515,561	1,673,669	14,749,218	3,659,247	35,264,779
COLORADO	5,857,721	149,415	1,029,186	4,868,051	128,130	606,056	1,157,316	5,474,107
CONNECTICUT	5,163,126	678,198	571,313	2,813,509	431	1,448	571,743	2,814,957
DELAWARE	1,021,826	69,671	162,668	543,997	0	0	162,668	543,997
DIST. OF COLUMBIA	2,822,611	3,740	279,488	1,069,853	0	0	279,488	1,069,853
FLORIDA	21,566,050	336,238	1,224,067	15,853,988	533,884	5,521,975	1,757,951	21,375,963
GEORGIA	11,378,270	157,684	636,152	7,052,638	109,476	1,299,975	745,628	8,352,613
HAWAII	2,515,376	28,679	66,619	447,037	0	0	66,619	447,037
IDAHO	1,127,654	62,722	189,663	924,059	16,735	80,944	206,398	1,005,003
ILLINOIS	17,083,816	1,047,884	2,845,967	13,401,611	583,508	2,952,440	3,429,474	16,354,051
INDIANA	7,896,578	255,555	862,187	4,274,864	302,292	1,521,966	1,164,478	5,796,830
IOWA	2,792,145	114,987	476,094	2,281,585	161,132	845,472	637,226	3,127,057
KANSAS	3,129,500	93,040	302,646	2,288,603	69,739	620,810	372,384	2,909,413
KENTUCKY	4,869,495	130,668	216,386	2,168,069	55,399	530,341	271,785	2,698,410
LOUISIANA	8,100,144	183,405	281,008	3,381,270	99,724	1,124,980	380,732	4,506,250
MAINE	1,342,298	111,693	339,565	1,058,396	0	0	339,565	1,058,396
MARYLAND	9,443,492	119,213	736,243	2,971,285	264,487	840,126	1,000,730	3,811,411
MASSACHUSETTS	10,819,969	541,307	2,309,681	8,259,952	186,455	616,264	2,496,136	8,876,216
MICHIGAN	14,865,006	1,023,954	1,523,816	7,783,778	624,621	3,139,916	2,148,437	10,923,694
MINNESOTA	5,755,290	92,165	776,420	3,748,151	259,878	1,254,197	1,036,298	5,002,347
MISSISSIPPI	3,905,307	149,363	167,202	2,073,156	16,159	211,668	183,361	2,284,824
MISSOURI	7,751,804	181,081	549,072	4,540,962	185,332	941,500	734,404	5,482,462
MONTANA	1,509,603	84,229	164,406	1,172,653	47,039	282,050	211,445	1,454,704
NEBRASKA	2,149,609	57,329	307,107	1,437,255	80,228	367,479	387,336	1,804,734
NEVADA	1,903,394	6,339	197,983	1,223,672	30,305	117,513	228,288	1,341,185
NEW HAMPSHIRE	1,656,083	100,739	532,241	1,827,857	0	0	532,241	1,827,857
NEW JERSEY	11,415,152	2,790,235	2,055,469	7,082,915	460,054	1,389,692	2,515,523	8,472,607
NEW MEXICO	1,978,630	67,519	306,733	1,426,480	3,438	16,005	310,171	1,442,485
NEW YORK	22,496,890	555,553	2,345,020	12,338,146	498,544	3,074,906	2,843,564	15,413,051
NORTH CAROLINA	7,807,477	205,421	465,118	3,835,822	253,298	1,918,105	718,416	5,753,927
NORTH DAKOTA	700,156	29,344	107,311	507,579	22,947	108,541	130,258	616,120
OHIO	16,672,104	310,776	1,591,308	7,742,924	886,915	4,034,035	2,478,223	11,776,959
OKLAHOMA	4,219,436	172,925	319,564	2,636,063	50,859	515,030	370,423	3,151,093
OREGON	2,783,741	154,591	435,428	1,726,947	124,928	535,654	560,356	2,262,601
PENNSYLVANIA	16,345,959	1,203,238	3,099,148	5,202,358	1,687,510	1,694,600	4,786,659	6,896,958
RHODE ISLAND	1,723,722	49,443	419,994	1,431,702	0	0	419,994	1,431,702
SOUTH CAROLINA	4,277,004	53,690	227,024	2,426,395	65,837	753,014	292,861	3,179,409
SOUTH DAKOTA	625,611	35,119	136,946	647,756	8,661	40,965	145,607	688,721
TENNESSEE	8,937,592	230,260	381,350	4,660,123	91,494	1,030,522	472,843	5,690,645
TEXAS	27,479,592	601,873	1,572,435	11,593,567	956,245	7,256,096	2,528,679	18,849,664
UTAH	2,578,625	85,175	342,262	1,618,898	13,909	65,792	356,171	1,684,690
VERMONT	665,180	45,321	184,808	688,640	0	0	184,808	688,640
VIRGINIA	10,888,871	150,097	817,977	3,963,517	369,370	1,507,333	1,187,347	5,470,850
WASHINGTON	6,855,128	392,670	763,458	3,718,455	174,686	840,442	938,145	4,558,897
WEST VIRGINIA	2,219,598	130,375	163,056	659,402	38,774	133,698	201,830	793,101
WISCONSIN	5,843,939	219,105	667,406	3,253,341	244,474	1,161,503	911,880	4,414,844
WYOMING	520,695	28,434	131,535	622,161	3,148	14,889	134,683	637,051
UNITED STATES	377,652,055	19,025,540	36,754,817	205,416,064	11,702,098	65,880,545	48,456,915	271,296,609
PUERTO RICO	1,383,828	0	33,958	348,559	150,322	630,947	184,281	979,507
GRAND TOTAL	379,035,884	19,025,540	36,788,775	205,764,623	11,852,421	66,511,493	48,641,196	272,276,116

NOTE -- THIS TABLE INCLUDES DATA OF REPORTING LOCAL EXCHANGE CARRIERS PLUS ALASCOM.

-- SEE TABLE 2.10 FOR DATA OF INDIVIDUAL CARRIERS.

Source: FCC

Table 17

Advanced Technology Deployment by Regional Bell Operating Companies by Year-end 1990 and 1994

	ISDN		Digital Deployment		Fiber Deployment	CCSS7 Deployment	
	% of CO's	% of Access Lines	% of CO's	% of Access Lines	% of total miles of Cable	% of CO's	% of Access Lines
Ameritech							
1990	6.0	.3	64.5	40.4	3.8	24.1	42.6
1994	13.3	.7	77.7	54.5	6.1	55.6	66.8
Bell Atlantic							
1990	7.6	.1	72.9	48.3	4.7	54.7	75.5
1994	86.8	1.2	86.8	65.5	10.4	91.3	91.6
BellSouth							
1990	3.3	1.9	78.2	51.1	4.2	34.2	57.8
1994	33.5	7.9	82.9	66.4	7.5	94.6	95.5
Nynex							
1990	2.6	.2	57.9	56.7	4.1	14.1	8.1
1994	4.1	.3	85.0	70.2	6.9	75.2	89.1
PacTel							
1990	4.2	.1	59.4	35.6	2.8	32.3	30.7
1994	14.4	.3	66.9	43.1	5.2	34.0	31.8
SW Bell							
1990	3.4	.2	31.9	25.8	2.6	1.3	3.1
1994	7.2	.6	74.4	44.9	3.4	24.9	66.5
US West							
1990	4.8	.4	38.4	35.3	4.1	1.0	2.1
1994	6.9	.5	55.5	44.0	7.9	18.3	53.8

Source: Statement on behalf of the International Communications Association before the Subcommittee on Telecom and Finance of the Committee on Energy and Commerce of the U.S. House of Representative, May 10, 1990.

INTEREXCHANGE MARKET

INTEREXCHANGE MARKET

The market for long distance (interLATA) services has been radically changed by competition. Until 1969, AT&T was the only long distance carrier. In that year, the FCC authorized MCI to provide specialized long distance service. Since then, over 500 companies have sprung up to provide private and/or common-carrier interexchange voice and/or data services. Most of these companies resell capacity of larger carriers and serve small niche markets. Although the market for international long distance is large and growing, this study concentrates on domestic interLATA service.

The interexchange market has spurred significant development in transmission media including satellite, microwave, and fiber optics. The thrust of these technologies has been to increase the capacity and cost efficiencies of the networks, allowing carriers to become more competitive in the marketplace. Consumers have benefitted greatly from these initiatives as average long distance rates have plummeted.

The total value of the long distance market has increased from $32.5 billion in 1985 to $52.1 billion in 1990 (see Table 18). Three carriers--AT&T, MCI, and US Sprint--hold almost 90 percent of the market (see Fig.13). The total number of long distance (intraLATA and interLATA) calls completed in 1990 amounted to some 67 billion. AT&T Communications, by far the largest long distance (interLATA) carrier, had long distance revenues of $34.6 billion in 1989, down slightly from $35.2 billion in 1987. AT&T's share of the total market has decreased from 84.6 percent in 1985 to 68.0 percent in 1988. MCI, the second largest long distance carrier, had revenues of $6.2 billion in 1989, up from $3.9 billion in 1987. MCI's share of the market has edged up from 8.6 percent in 1987 to 12.2 percent in 1989. US Sprint's long distance revenue increased from $2.8 billion in 1987 (6.2 percent of the total) to $4.3 billion in 1989 (8.4 percent of the total). Other carriers such as Telecom*USA, Cable and Wireless, and Allnet are beginning to gain on the leaders as they offer advanced voice and data services in niche markets.

According to a study sponsored by The Competitive Telecommunications Association (CompTel), long distance carriers showed an aggregate $1 billion loss in 1987, but reversed that loss in 1988 to achieve a $2 billion profit. Lower tier carriers (those with less than $1 billion in revenue) experienced 45 percent revenue growth, compared to 12 percent for the big three--AT&T, MCI, and US Sprint. Increased revenues from business customers contributed heavily to overall revenue growth. Revenue per business customer increased 5.5 percent.

The CompTel study also revealed how carrier revenue was allocated. Of $51.7 billion in revenue in 1988, 37 percent went to access charges, 29 percent to facilities, 10 percent to general and administrative expenses, 9 percent to operations and maintenance, 8 percent to sales and advertising, 6 percent to depreciation and amortization, and the balance to other miscellaneous items (including profit).

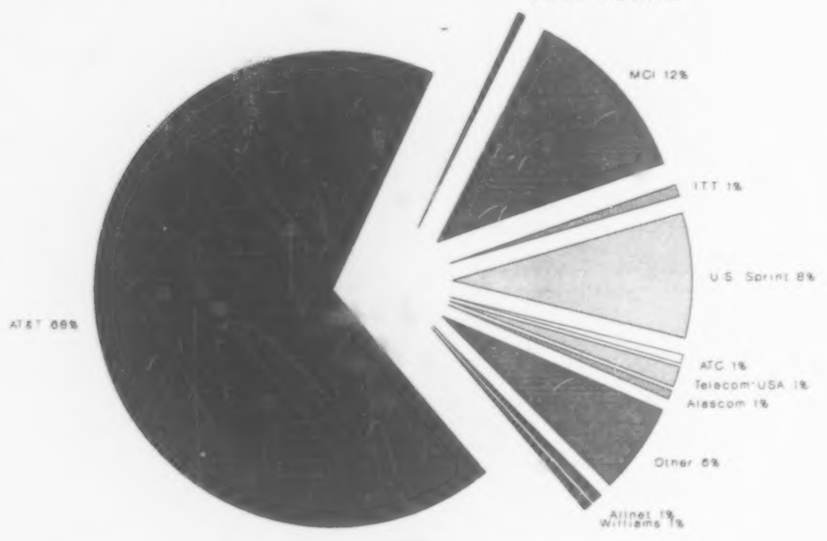
A significant consolidation is underway in the long distance market, as small regional companies acquire or merge with other small regional companies or form consortiums. For instance, Telecom*USA, the result of a recent merger between two regional carriers--SouthernNet and Teleconnect--was acquired by MCI during 1990. Advanced Telecommunications of Atlanta has been actively acquiring regional carriers. National Telecommunications Network (NTN) and National Switch Network (NSN) are two consortiums (with some shared members) formed to enhance the existing capabilities of their members. NTN was established to offer nationwide private line capacity and facilities resale capabilities, and NSN was created to share switch and fiber facilities.

By year-end 1989, 2.2 million route miles of fiber optics had been laid by long distance carriers (58 percent of that was "lit," *i.e.*, in use). This growth will abate slightly in the near future as most facilities-based carriers complete their fiber networks. AT&T will continue to deploy fiber for the next two years as it completes its $6 billion network upgrade begun in 1987. By year-end 1990, AT&T's network will be virtually 100 percent digital, with 24,000 miles of fiber optic cables and 53,000 miles of digital network coverage.

These fiber networks have been constructed not only to increase the speed and efficiency of the network, but also to expand the capacity of the network to offer advanced services. In fact, while basic long distance service continues to dominate and account for almost half of the long distance market (see Fig. 14), much of the current 14 percent average annual growth in the market is in advanced services such as 800, 900, and data transmission (see Table 19).

The market for 900 services (long distance pay per call), currently offered by AT&T, MCI, US Sprint, and Telesphere, is expected to grow from $500 million in 1989 to $4 to $5 billion by 1995. Growth in 900 services will come mainly at the expense of growth in 800 services (toll-free long distance), which should remain relatively stable through the next several years. As remote data processing becomes ubiquitous, as with point of sale terminals, automatic teller machines, credit card validation terminals, etc., data transmission services are likely to grow from $800 million in 1988 to $5 to $6 billion by 1995.

Figure 13

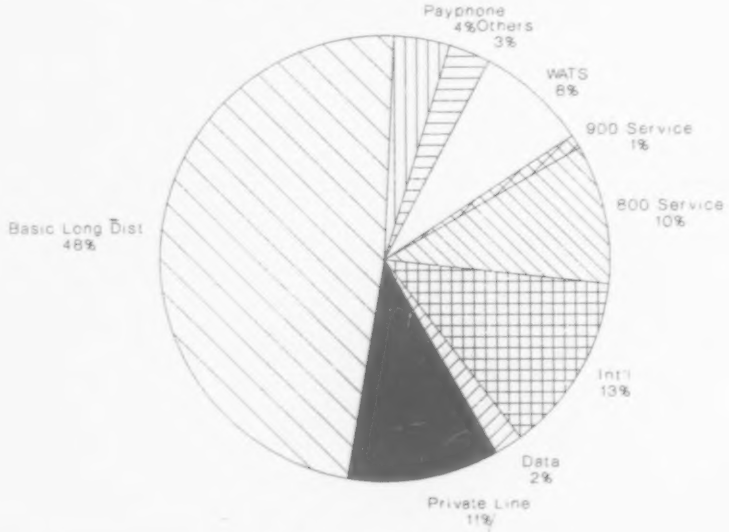


1989 Long Distance Market, by Carrier

1989 Market = $50.9 Billion

Source: NATA Market Research Dept.

Figure 14



1989 Long Distance Market, by Type of Service

1989 Market = $50.9 Billion

Source: Estimated by the NATA Market Research Dept. based on various sources

Table 18

Interexchange Revenues* and Market Shares of Major Service Providers, 1985-1988

	1985	1986	1987	1988(e)	1989	1990(e)
	billions of dollars					
AT&T	27.5	32.3	35.2	35.4	34.6	35.0
MCI	2.5	3.6	3.9	4.9	6.2	6.7**
U.S. Sprint	1.2	2.6	2.8	3.4	4.3	4.4
Others	1.3	2.9	3.3	3.2	5.8	6.0
Total	32.5	41.4	45.2	46.9	50.9	52.1
	percent of total					
AT&T	84.6	78.1	77.9	75.5	68.0	67.2
MCI	7.6	8.7	8.6	10.4	12.2	12.9
U.S. Sprint	3.6	6.2	6.2	7.2	8.4	8.4
Others	4.1	7.0	7.3	6.9	11.4	11.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Excludes Local Exchange Carriers
** Excludes Telecom-USA

Source: Estimated by the NATA Market Research
Department, based on industry sources

Table 19

1989 Long Distance Marketplace, by Industry Segment

Industry Segment	Industry Revenues ($ Bil)	Estimated 1989-1995 CAGR	1989 Market Share AT&T	MCI	Sprint	Other
Basic Long Distance	$ 24.4	10%	65%	16%	11%	8%
International	6.7	20%	80%	12%	8%	0%
Private Line	5.6	15%	87%	8%	4%	1%
800	5.0	10%	80%	15%	4%	1%
WATS	4.1	9%	70%	15%	10%	5%
Payphone	2.0	10%	80%	8%	7%	5%
Data	1.0	22%	89%	7%	3%	1%
900	1.0	30%	88%	2%	4%	6%
Other	1.5	N/A	N/A	N/A	N/A	N/A
Total	50.9	N/A	68	12	8	12

Source: Estimated by the NATA Market Research Department based on various industry sources.

NETWORK EQUIPMENT MARKET

NETWORK EQUIPMENT MARKET

The network equipment market consists principally of telecommunications equipment used by common carriers to provide telecommunications services. (For more information on common carriers, see the section on telecommunications services market.) The public telecommunications network consists of some 25,000 telephone CO installations and more than 3 billion circuit miles of transmission capacity. Typically, switching equipment represents approximately 50 percent of total telephone industry investment. The national common carrier network constitutes a capital investment exceeding $250 billion.

In terms of value, the principal equipment categories include central office switches, fiber optic cables and associated electronics, and outside plant. Other important equipment categories include various types of transmission equipment, data communications equipment (see section on data communications equipment), and mobile communications equipment (see section on mobile communications).

The network equipment market grew rapidly from $5.0 billion in 1984 to $9.1 billion in 1989, as long distance carriers upgraded their networks with fiber optics (see Table 27). In addition, local carriers have been completing the changeout of their electromechanical switches to electronic switches. In fact, many of the local exchange companies have begun the conversion of their switches to digital in anticipation of ISDN and various advanced services requiring digital switching capability. The number of digital switches installed increased from about 900 in 1985 to an estimated 3500 in 1989. In addition, despite the fact that new switches being sold are predominantly digital, the market for expansions and upgrades of existing analog switches remains relatively strong.

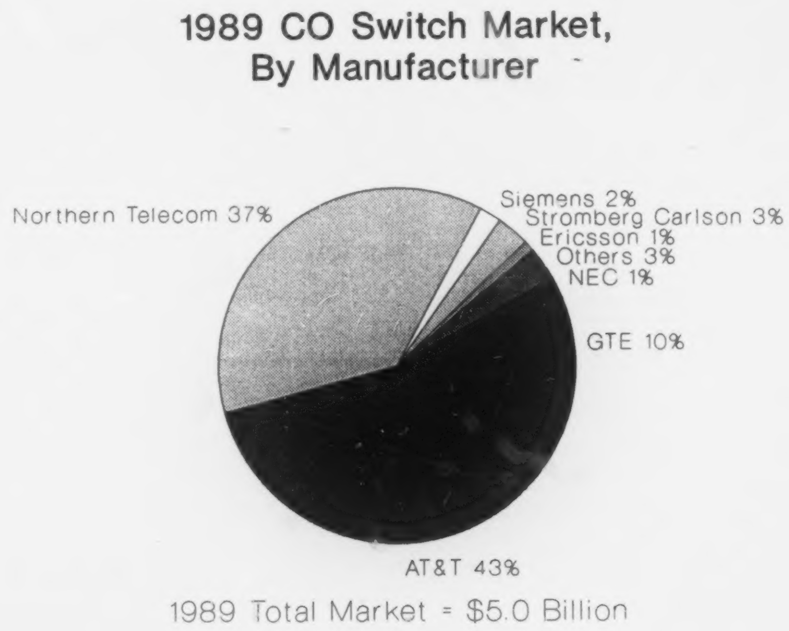
The largest segment of the network equipment market is represented by the market for CO switches, which grew from $2.9 billion in 1984 to $5.5 billion in 1986 before slowing to $5.0 billion in 1989. The two largest suppliers of CO switches in the marketplace are AT&T and Northern Telecom (see Fig. 15). Northern Telecom is a Canadian-based subsidiary of Bell Canada, the dominant local exchange company in Canada. Northern Telecom has many years of experience producing switches for the Canadian network, which is virtually identical technologically to the U.S. network.

Northern Telecom has been rapidly increasing its share of the CO switch market at the expense of AT&T. Sales of Northern Telecom's switches increased by a compound annual growth rate of 20.3 percent during the period 1984 to 1989, while AT&T switch sales have remained fairly flat. Reasons for this vary, but in general since divestiture many of the RBOCs have been asserting their independence from AT&T by turning to Northern Telecom. In addition, there have been some complaints that AT&T has been purposely keeping the centrex feature capability of its CO switches at a minimum level to reduce competition with its PBXs.

AT&T has not sat idly by watching its RBOC market share slip. In mid 1988, AT&T and GTE signed an agreement whereby AT&T would gradually take over GTE's CO switch business. Considering that GTE is the largest single independent local exchange company in the United States and that GTE's share of the total CO business in 1989 was 10 percent, the agreement represents an aggressive move on AT&T's part to maintain and even increase its total share of the CO switch marketplace.

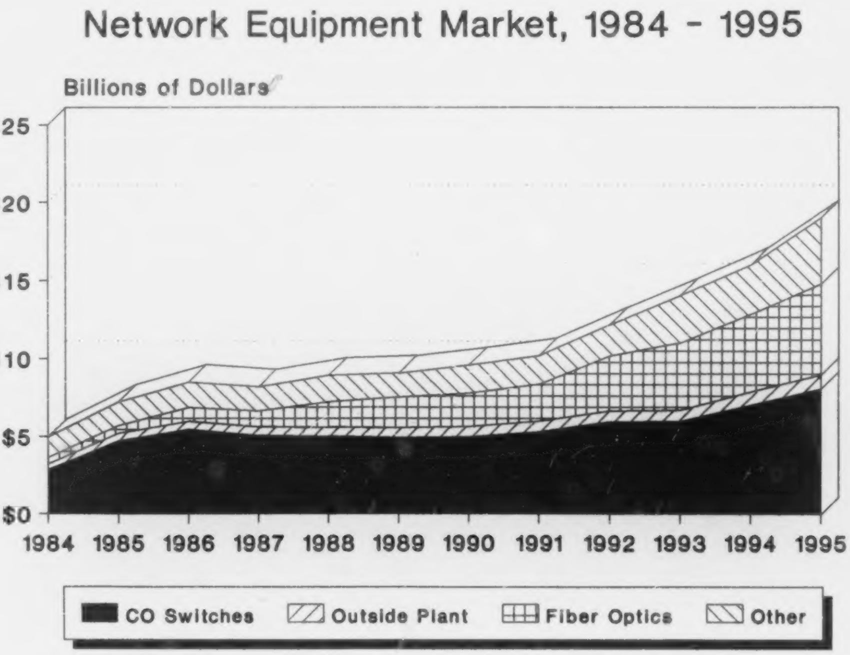
Other companies that have had minimal success at selling switches have been Stromberg Carlson, Siemens, Ericsson, and NEC. (In late 1990, Siemens and Stromberg Carlson merged their U.S. CO switch operations.) These companies have tried for several years to crack the RBOC market, but for the most part have been excluded from large switch orders. What keeps these companies in the marketplace is the anticipation of possible orders in the next big wave of switch changeout, which is likely to begin accelerating between 1992 and 1995 as the RBOCs replace about 60 million analog exchange access lines (about 55 percent of the total) with digital lines. While this changeout will provide tremendous opportunities for switch manufacturers, profitability of the sales is likely to decrease. Prices for CO switches have been on a downward trend for the past few years and are not likely to increase significantly in the near future as competition for RBOC business intensifies.

Figure 15



Source: NATA Market Research Dept.

Figure 16



Source: NATA Market Research Dept.

Table 20

Network Equipment Market*, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR* (Percent)
			-millions of dollars-				
Central Office Switches	2,900	4,750	5,500	5,100	5,050	4,975	11.4
Fiber Optics	410	500	883	1,011	1,650	1,990	37.1
Outside Plant	350	475	500	550	575	610	11.8
Other	1,320	1,510	1,630	1,550	1,680	1,520	2.9
Total	4,980	7,235	8,513	8,211	8,955	9,095	12.8

	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	CAGR* (Percent)
			-millions of dollars-				
Central Office Switches	5,025	5,350	5,986	6,810	7,075	8,110	10.0
Fiber Optics	2,150	2,375	3,520	4,300	4,950	5,810	22.1
Outside Plant	635	652	683	715	845	900	10.7
Other	1,792	1,825	1,976	3,022	3,155	4,233	18.8
Total	9,602	10,202	12,165	14,847	16,025	19,053	14.7

* Does not include cellular network equipment
** Compound Annual Growth Rate
(e) Estimated
(p) Projected

Source: NATA Market Research Department

CUSTOMER PREMISES EQUIPMENT OVERVIEW

CUSTOMER PREMISES EQUIPMENT OVERVIEW

In this report, the principal types of customer premises equipment (CPE) addressed include PBXs, key/hybrid systems, facsimile terminals, voice/call processing equipment, data communications equipment (all types, whether placed on the customer's premise or not), consumer telecommunications products, and payphones. The markets for these products, which are sometimes also referred to as terminal equipment, represents at least half the entire telecommunications equipment marketplace. The bulk of this equipment is used by businesses to enhance internal and external communications. Businesses have come to understand the significant role communications plays in productivity, efficiency, and profitability. Increasingly, communications capabilities are viewed as strategic assets and as such are given strategic goals of increasing revenue and decreasing costs. To achieve those ends, business users are becoming more sophisticated and proactive in the demands they make on their suppliers of equipment and services. In filling their demands, equipment vendors face both challenges and opportunities.

The various CPE marketplaces are somewhat intertwined, but are quite separate in terms of market trends, technologies, distribution channels, etc. Therefore, while many of the markets for the different types of CPE are addressed separately, there are some facets of the CPE marketplace that affect a variety of products. Included are the implications of ISDN, the role of systems integration in the marketplace, the growth of the used equipment market (typically called the secondary equipment market), and the development of the market for CPE used in conjunction with centrex services.

CPE Purchaser Profile

According to a study of business telecommunications purchasers commissioned by *Teleconnect Magazine*, the average business spent $5.8 million on CPE in 1989. Expected spending for 1990 was down about 14 percent to $4.9 million. The most widely used products were facsimile terminals, with 89 percent of businesses using them; PBXs were next, with 76 percent; headsets followed with 75 percent; power protection devices with 66 percent; key systems with 63 percent; call accounting with 61 percent; paging, also with 61 percent; LANs with 50 percent; voice mail with 49 percent; T-1 equipment with 47 percent; cellular phones with 42 percent; ACDs with 38 percent; and automated attendants with 33 percent.

When asked what CPE products the businesses would purchase in 1990, 35 percent indicated they would buy facsimile terminals, 30 percent said they would purchase voice mail, 27 percent said headsets, 25 percent said PBXs, 22 percent said automated attendants, 22 percent said call accounting, 21 percent said key systems, 19 percent said LANs, 18 percent said power protection devices, 17 percent said cellular, and 16 percent said ACDs. Other products likely to see significant growth in demand include videoconferencing, voice response units, telemanagement software, and T-1 equipment. These are clearly the types of equipment CPE vendors should concentrate on.

ISDN

The implementation of ISDN will undoubtedly have a significant impact on the CPE marketplace. As business users begin to understand and appreciate the advantages of ISDN, they will begin to make buying decisions that will stimulate the market for many types of CPE but depress the market for others. The impact on still other CPE products is largely speculative and will be known only as ISDN implementation develops. Overall, the ISDN CPE market is expected to grow to over $5.0 billion by 1995. Products sold in an ISDN environment include terminal adapters, voice/data/video terminals, PBXs, key systems, multiplexers, local area network bridges, and Group 4 facsimile terminals.

Terminal adapters allow ISDN connectivity with non-ISDN user equipment. These products ease the transition to ISDN and protect the installed base from instant obsolescence. Terminal adaptors currently represent the largest selling segment of ISDN CPE. The market for these products, however, will peak early as ISDN terminals become commonplace.

The market for PBXs in an ISDN environment is difficult to predict. So far, the RBOCs have been promoting the basic-rate interface (BRI) for ISDN (144 kilobits per second for 2 "bearer" channels and 1 data (signalling) channel). BRI, which has more firmly entrenched standards, is typically used to connect terminal equipment directly to the network. RBOCs have incorporated this technology into their ISDN trials. With BRI, the RBOCs have positioned digital centrex as the seamless gateway to ISDN. This has frustrated PBX vendors who typically rely on the primary-rate interface (PRI) for connecting PBXs with the other PBXs and with the network (1.544 megabits per second for 23 bearer channels and 1 data channel). Virtually all major PBX manufacturers have recently announced PBX products with PRI capability. As with the current competitive battle between PBXs and centrex, users will be forced to choose between CO-based ISDN centrex services and PBX-based ISDN capability. The battle will be hard fought and the RBOCs already have a slight head start. On the other hand, PBX vendors have a formidable ally in AT&T. AT&T and other interexchange carriers are incorporating PRI in long distance ISDN trials. It is a bit too early to predict the outcome, but an optimistic forecast would put the market for PBXs with PRI capability at $3.0 billion by 1995.

The market for digital ISDN-compatible key systems is likely to be stimulated by implementation of ISDN. For the same reasons that CO-based ISDN centrex will have a moderating effect on the demand for PBXs, ISDN centrex will stimulate the demand for key systems. As ISDN centrex increases its share of the business market, key systems will become important adjunct equipment, giving the user increased functionality and flexibility. The market for adjunct key systems to be used with CO-based centrex ISDN should experience strong growth and amount to about $50 million by 1995.

More than any other segment of the CPE business, the data communications equipment market is likely to experience the most change as ISDN is implemented. Specifically, low-end LANs will likely be displaced by CO-based LANs as the data handling capability of CO switches is enhanced through digital architecture. The market for modems will decline as end-to-end digital connectivity obviates their need. The market for separate packet switching equipment will decrease as digital CO switches assume much of the packet switching requirements of the public network. New and growing data communications markets include LAN-ISDN gateways and terminal adapters. In addition, when PRI applications begin to proliferate, the market for multiplexers will accelerate.

One CPE market likely to explode is the market for Group 4 fax terminals. These fax terminals will bring a new level of utility to facsimile transmission, as the expanded capabilities include high transmission speed (about 5 seconds per page) and resolution high enough to use faxed copies as original documents.

Systems Integration

Systems integration can be defined as the combining of hardware, software, and communications within a total package. Systems integration is the sale of applications-oriented solutions to meet a customer's specific telecommunications/data communications needs. Some products systems integrators typically offer as part of their packaged solutions include PBXs, key systems, voice mail, fax terminals, LANs, automatic call distributors (ACDs), automated attendants, paging systems, call accounting systems, call/voice processing equipment, facilities management software, centrex, long distance, and other private and public network services.

Systems integration, which developed in the computer environment, is relatively new to the telecommunications marketplace. However, since deregulation and the AT&T divestiture, the implementation of a business communications system has become much more complicated for the end user. Increasing numbers of users (including government agencies) are turning to systems integrators to tailor a communications system to their specific needs and applications. There are currently hundreds of systems integrators offering a wide variety of products and services. The revenue potential for systems integration is staggering. In 1989, revenue to systems integrators amounted to $8 billion. By 1992, revenues around $14 billion can be expected. The market is composed of two distinct types of customers--business and government users. The business segment is expected to grow at almost 40 percent per year for the next several years, while the government sector, currently the larger of the two, will grow by about 15 percent per year.

Systems integration will likely continue to stimulate CPE sales. In 1989, about $2.5 billion in CPE was sold through systems integrators. That amount is likely to reach $5.6 billion by 1992.

Secondary Equipment

One of the most rapidly growing aspects of the CPE market is the demand for used equipment (usually referred to as the secondary equipment market). The bulk of the equipment sold in the secondary market is key systems and PBXs but, as the secondary market develops, other types of equipment are also being remarketed. These include voice mail, call accounting, and automatic call distributors. The industry has three standards for the equipment, depending on the level of reconditioning--used, refurbished, and remanufactured. The differences between these classifications can be important not only to the customer, but also in terms of warranties.

> USED EQUIPMENT--As implied, used equipment refers to products that have been pulled from service. Usually this equipment has not been cleaned or tested. Most warranties on used equipment, if available at all, will not exceed a 30-day period from the date of purchase.
>
> REFURBISHED EQUIPMENT--Refurbished equipment is the next step up the ladder. Industry standards require not only that refurbished equipment be cleaned and tested, but that faulty components be replaced. Refurbished equipment also has an extended warranty period, usually 90 days.
>
> REMANUFACTURED EQUIPMENT--The highest level equipment can reach on the secondary market is remanufactured. Remanufactured equipment goes through

rigorous specification testing and reconditioning. The difference between new and remanufactured equipment is slight. Equipment that has been factory remanufactured has had faulty components replaced with new parts. This is typically not the case with refurbished equipment, where bad components may be replaced with used ones. Remanufactured equipment usually comes with a full one-year warranty.

While the secondary market is clearly becoming a force in the CPE marketplace, there are certain constraints to its continued expansion, at least in the short term. Only a small percentage of users are even aware of the secondary market. Before users will consider buying used equipment, they need to be educated about the cost savings and other advantages of secondary equipment.

In addition, many of the initial remarketers were "fly-by-night" companies that were only after a quick profit and did not stay around for service and repair. Users were not satisfied, and a questionable reputation began to haunt the industry. This perception problem is changing, however, as self-policing and official complaint-lodging mechanisms are raising industry standards. As more users learn of these developments and become more aware of avenues of recourse, they will begin to have more faith in the equipment and the vendors. Also, remarketers are beginning to grow and become substantial businesses with strong customer service resources. These capabilities help customers feel more comfortable about their purchases.

Finally, one of the main reasons users remain skeptical about the secondary equipment market is the relative lack of support from manufacturers. AT&T has traditionally supported the secondary equipment market, which has had some positive effect on users. However, there are dozens of other manufacturers controlling most of the installed base of equipment who traditionally have not supported the market, thereby reducing its legitimacy. But this is changing. During 1989, both ROLM and Northern Telecom announced their support of this marketplace. Other manufacturers are likely to follow suit as they try to maintain their installed base. This increasing manufacturer support will doubtless have a very positive effect on the users' perception of the industry.

The market for secondary equipment has been estimated at about $475 million in 1989, with expectations that it will increase about 15 percent per year through the next several years. Currently, the bulk of the market (40 percent) is in sales directly from the remarketer to the end user. About 33 percent of the market is remarketers' sales to dealers such as interconnects, while 18 percent represents sales from the user to the remarketer. The balance of the market is accounted for by intracompany transfers and user-to-user sales.

In terms of value, the market is split fairly evenly between system sales and sales of parts only. More dealers offer parts than complete systems, but the dollar value of the systems sales compensates for the smaller number of remarketers.

Estimates made in 1988 of the value of system sales indicate that secondary PBX sales surpass secondary key system sales. This is true not only because PBXs cost more, but because established vendors, which are the most likely to sell systems, usually sell more PBXs than key systems in terms of dollar value. As for PBX manufacturer market shares in the secondary market, AT&T products have about 40 percent, Northern Telecom about 20 percent, Rolm 15 percent, Mitel 13 percent, and NEC 7 percent.

The secondary market is currently doing very well, since there exists a window of opportunity. Customers who bought their systems in 1984 and 1985 are beginning to look for replacement systems. There is also a certain amount of confusion in the marketplace regarding technology and price. How will ISDN be incorporated into CPE? Is centrex the "true" gateway to ISDN? Is digital the technology of choice for key systems? These questions lead many users to view the secondary market as a relatively inexpensive "stopgap" measure until some of these issues are resolved. Beyond these issues, the slowdown in the U.S. economy that began in the second half of 1990 will likely give an added push to the secondary market as users try to get the most they can out of their shrinking budgets. It may be that the secondary market will always remain strong; it is a bit too early yet to tell.

Centrex CPE

Centrex services were introduced by AT&T and the Bell Telephone System around 1961 as the preferred service offering for large institutional and corporate accounts. In order to provide centrex, the local telephone company dedicates lines and a portion of the CO switch to an individual customer. Therefore the intelligence and switching capability of the system reside at the CO rather than on the customer's premise, as is the case with a PBX-based system. (See the section on the PBX/Centrex marketplace for a complete discussion.)

Prior to the AT&T divestiture, AT&T deliberately encouraged a decline in centrex penetration due to AT&T's commitment to the PBX marketplace. In the post-divestiture climate, however, the RBOCs have been precluded from manufacturing (although they have been allowed to sell CPE within certain guidelines), and have moved to rejuvenate and promote centrex services aggressively, especially in urban markets. The RBOCs have made centrex their flagship business telecommunications offering, and to make it more competitive with PBXs they have fought for, and won, rate reductions. In addition, the RBOCs have enhanced centrex with advanced features once available only with a PBX.

In this environment centrex has flourished, and so has the market for CPE used in conjunction with centrex. The most widely used types of such equipment are key systems, with almost 75 percent of all centrex installations using key stations. Other CPE frequently used with centrex includes answering machines, auto dialers, intercoms, paging systems, ACDs, call accounting, and voice mail.

In value, the total annual sales of all centrex CPE for 1989 amounted to about $325 million, with the biggest sellers being voice messaging equipment at about $175 million, key systems at about $90 million, and ACDs at about $35 million. In units, big sellers in 1989 included key systems at about 35,000 systems, and call accounting and voice messaging equipment, each at about 4,000 units. The markets for these products are likely to increase as centrex penetration increases.

A development that may keep the market in check, at least for products such as ACDs and voice mail, is that the RBOCs are beginning to incorporate ACD and voice mail features into their centrex offerings. This will cause some displacement of CPE, but so far the sophistication of these centrex features is not equal to the CPE versions and their cost is relatively high. In the near term, at least, the CPE versions should do quite well.

SELECTED CPE MARKETS:

PBX/CENTREX MARKET
KEY/HYBRID MARKET
DATA COMMUNICATIONS EQUIPMENT MARKET
FACSIMILE TERMINAL MARKET
CONSUMER TELECOMMUNICATIONS MARKET
CALL/VOICE PROCESSING MARKET
PUBLIC PAYPHONE MARKET

SELECTED CPE MARKETS

PBX-Centrex Market

Introduction

Private branch exchanges (PBXs) are multi-line business telephone systems that give users pooled access to a group of external telephone access lines provided by the local telephone company's central office. PBX systems provide essentially the same services as a telephone company central office--dial tone signaling and call routing--but on a much smaller scale and typically from equipment located on a customer's premises. A PBX is often referred to as a switch because, like a central office, it automatically establishes and routes (or switches) calls between the various stations on a user's premises or between an on-premise extension and the public switched network. A distinguishing characteristic of PBX systems is the users' pooled access to outside CO lines. When a user dials "9" or another designated code from an extension, the switch automatically seizes an idle outside line from a pool of available CO lines to complete the call.

In general, PBXs are being equipped with more and more features such as integrated call distributors, cost accounting, and voice messaging, as well as the ability to bridge local area networks and have full data communications capability. Digital PBXs are replacing analog PBXs, which themselves replaced the old electromechanical types not too many years ago. Several manufacturers have recently announced ISDN-compatible PBXs. Even though ISDN is several years away from commercial implementation, manufacturers want to sell PBXs today that will be forward compatible.

"Centrex" is the generic name for a switching service offered by local telephone companies to business customers. Centrex service provides business with PBX-like features and capabilities directly from the central office, rather than through premises-based PBX equipment. That is, centrex service is provided from the same local switching center that provides business and residential customers alike with dial tone, local call-routing, and access to long distance networks. In order to provide centrex, the local telephone company dedicates lines and a portion of the CO switch to an individual customer.

Typically, centrex service consists of two elements: local-exchange access and switching, and intercom service with a package of call-processing features similar to those available from PBX systems. Centrex has generally been treated as a regulated service, and prices are usually set in tariffs approved by state regulators. There are two growing trends, however--to allow flexible tariffing of centrex, sometimes including customized service packages to larger customers where the actual price of the centrex service itself is not revealed; and to deregulate centrex service completely. In any event, centrex prices tend to vary from state to state.

Three types of CO switches, distinguished by the technologies they embody, currently provide centrex service in various parts of the country: electromechanical, stored program-controlled electronic, and digital.

Prior to the breakup of the Bell System, the use of centrex--confined primarily to the very large business market--was declining; this was the result of a deliberate effort by AT&T. Since divestiture, however, the RBOCs have moved aggressively to rejuvenate and promote centrex, especially in urban markets. To increase the appeal of the service to businesses, the RBOCs have fought for and won deep centrex rate reductions, as well as enhanced feature offerings and lowered minimum line-size restrictions, from state regulators.

Centrex services are currently sold through three channels: the telephone companies' own sales force; authorized third party sales agents who get commissions from the telephone companies; and, in some cases, companies that want to sell CPE used with centrex services. These companies market centrex and arrange for centrex installation as a service to their customer, but do not receive any commissions for the sale. These vendors are then forced to make up the associated costs in other areas of the business. At the urging of NATA, the FCC has established the authorized sales agency program as an essential safeguard and precondition to relief for the BOCs from certain regulatory restrictions.

From a user's point of view, there are advantages and disadvantages to both centrex and PBXs. The debate concerning which is best has been a popular subject in the trade literature, with one source claiming one is superior to the other and the next source claiming the opposite. In terms of cost to the customer they are roughly equal, with PBXs having some advantage in the longer term, at least for certain system sizes (see Fig. 17). In terms of functionality and general user satisfaction rating overall, they come in a dead heat although there are individual differences in ratings by PBX manufacturers and RBOCs (see Figs. 18 and 19).

Market Review

Total annual PBX line sales have grown rather slowly over the past several years, from 3.8 million lines in 1984 to 4.2 million lines in 1989. As the replacement market picks up and ISDN stimulates demand, lines shipped are expected to increase to 5.4 million by 1995 (see Table 21 and Fig. 20). In systems, annual shipments increased from 25 thousand units valued at $2.8 billion in 1984, to 29 thousand valued at $2.9 billion in 1989. System sales are expected to amount to 32 thousand units valued at $3.4 billion in 1995. This upturn is expected as the PBXs that were purchased in the buying spree of 1984 and 1985 need replacement in the coming few years. Table 22 identifies the PBX market potential for the top 30 metropolitan areas.

In an attempt to shore up sales, PBX manufacturers have been buying up interconnect companies in recent years. Manufacturer direct sales (including sales through wholly-owned subsidiaries) increased from 50.4 percent of the market in 1986 to 55.0 percent in 1989 (see Table 23). Sales by independent interconnects decreased slightly from 24.1 percent to 21.8 percent (see Fig. 21). Wholesale houses lost ground from 9.7 percent to 6.2 percent for the same period, while the RBOCs' share went from 11.6 percent to 12.9 percent. The share of the total by independent telephone companies decreased from 4.2 percent in 1986 to 4.1 percent in 1989.

PBX-Centrex Installed Base

The total installed base of PBXs increased from 22 million lines in 1984 to 25 million in 1989 and is expected to increase to 29 million lines by 1995 (see Table 24 and Fig. 22). The segment likely to do the best between 1989 and 1995 will be 400-1,000 line systems. In the last few years, centrex growth has been especially strong in systems above 1,000 lines and systems between 1 and 99 lines. Telephone companies have targeted the largest businesses for centrex conversion and, for the most part, have encouraged centrex sales by authorized third-party sales agents to smaller customers.

For individual RBOCs, the largest installed base of PBX lines and centrex lines is in Bell Atlantic's territory, where over 4 million PBX lines and almost 2 million centrex lines are installed (see Table 25). As a percentage of total centrex/PBX installed base, Ameritech has the highest penetration of centrex lines at 34 percent (see Fig. 23). Figure 24 illustrates the degree of success the RBOCs have had in selling PBXs in their own territories.

In terms of individual end-user business markets, manufacturing had 4.1 million PBX lines installed and banking/finance and engineering/legal/management services each had 3.8 million PBX lines installed (Fig. 25). The government sector has the highest number of centrex lines in place (see Table 26). As a percentage of total centrex/PBX installed base, the government sector has the highest percentage of centrex lines installed (see Figure 26).

Manufacturer Trends

The PBX marketplace is highly competitive. Aside from the tremendous competition between centrex and PBXs, there are dozens of companies trying to capture an increasing market share for a product whose demand is relatively stable. This crowding of the PBX market inevitably has led to severe price competition. While there is a range of PBX prices based on system size and configuration, overall PBX prices per line decreased 2 percent on average between 1984 and 1989 (see Table 27 and Fig. 27). This compares to overall increases in the consumer price index of 22 percent since 1984. On average, the slide in PBX prices is expected to moderate as prices during the period 1990 to 1995 are expected to decrease by 0.6 percent per year. The resulting slide in profit margins has been highly problematic for PBX vendors who are having trouble maintaining revenue (see Table 28).

In addition, even though some suppliers have been able to increase total revenue, price erosion has made it very difficult for them to attain profitability. In fact, according to an article published in the *Washington Post* on August 11, 1989, only one manufacturer made a profit in the PBX business in 1988--Mitel. According to the *Post*, of the largest PBX suppliers, IBM/ROLM lost the most at $300 million, Northern Telecom lost $50 million, AT&T and NEC each lost $15 million, and Intecom/Wang lost $10 million. This downward trend is expected to continue as manufacturers spend more and more money on R&D to remain competitive in an ISDN environment while prices remain stable. Already, manufacturers have begun to prepare for an all-digital environment and are shipping significant quantities of digital PBXs.

The principal avenue manufacturers will take to increase their profitability is the continued acquisition of distribution channels to stabilize distribution and to take advantage of more profitable after-market sales. (Some analysts argue that direct distribution brings more problems than solutions and that in the long run direct sales are more costly than sales through independent distributors.) Currently, most manufacturers split their distribution between a variety of channels (see Fig. 28). This varied approach to distribution is likely to continue, but manufacturer direct sales will likely capture an increasing share of total PBX distribution. In addition, manufacturers are offering more in leasing and financing arrangements in order to be more attractive to customers. Several other manufacturer strategies are impacting the market. AT&T, and a few other manufacturers to a lesser degree, have declared a virtual installed base war. They are launching very creative campaigns to convince users of competing systems to switch brands of PBXs. In an effort to satisfy their installed base, manufacturers are increasingly making their PBXs modular in nature to reduce the requirement for a total system replacement when customers need system expansion or upgrading.

In market share, AT&T, Northern Telecom, and IBM/ROLM had the lion's share of the market in 1989, collectively accounting for 60 percent of the total lines shipped (see Table 29 and Fig. 29). Other important players include Mitel, NEC, Siemens, and Fujitsu, accounting for 8 percent, 8 percent, 4 percent, and 3 percent, respectively, of the total lines shipped in 1989.

In addition to ISDN-compatibility, PBX manufacturers are turning to new bells and whistles to increase PBX sales. The three that seem to be getting the most attention are wireless PBXs, PBXs with open application interfaces (OAI), and PBXs with links to host computers.

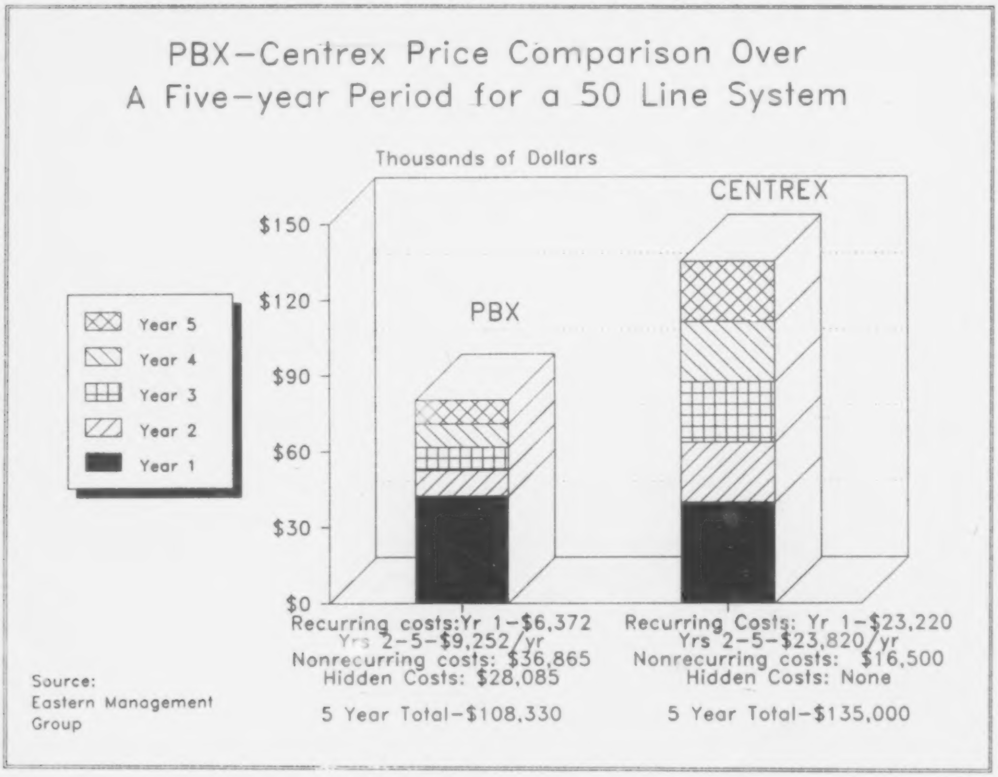
Wireless PBXs are those connected to the station sets by radio waves rather than wire. This gives users control of station placement and eliminates the need for a service call when merely moving station equipment from one office to another. The technology for wireless PBXs is not particularly revolutionary, but there is some problem with allocation of the limited radio spectrum. In addition, it is still unclear that users are willing to pay the additional upfront cost for a reduction in service costs downstream. Ericsson is pioneering wireless PBXs, and the results of their experience will substantially determine the fate of the market for these products. Nonetheless, there has been a great deal of attention focused on this concept, and optimistic forecasts estimate that wireless PBXs could account for 30 percent of sales by 1997.

PBXs with OAI are also generating significant interest. These are PBXs that allow users more control over the software integral to the PBXs. It gives users the option to go to outside software vendors to install software designed particularly for their own application. Most of the major PBX manufacturers have jumped on this idea to enhance user satisfaction.

PBX-to-host integration is a notion which has been around for a year or two, but with the announcement by IBM in the late spring of 1990 of CallPath Services Architecture a new dimension has been added. Essentially, PBX-to-host integration allows companies to build more efficient enterprise-wide networks that support integrated voice and data applications for incoming and outgoing traffic. PBX manufacturers expected to participate with IBM include AT&T, Northern Telecom, Rolm, and Siemens. A similar architecture announced by DEC will work with virtually all major PBX brands.

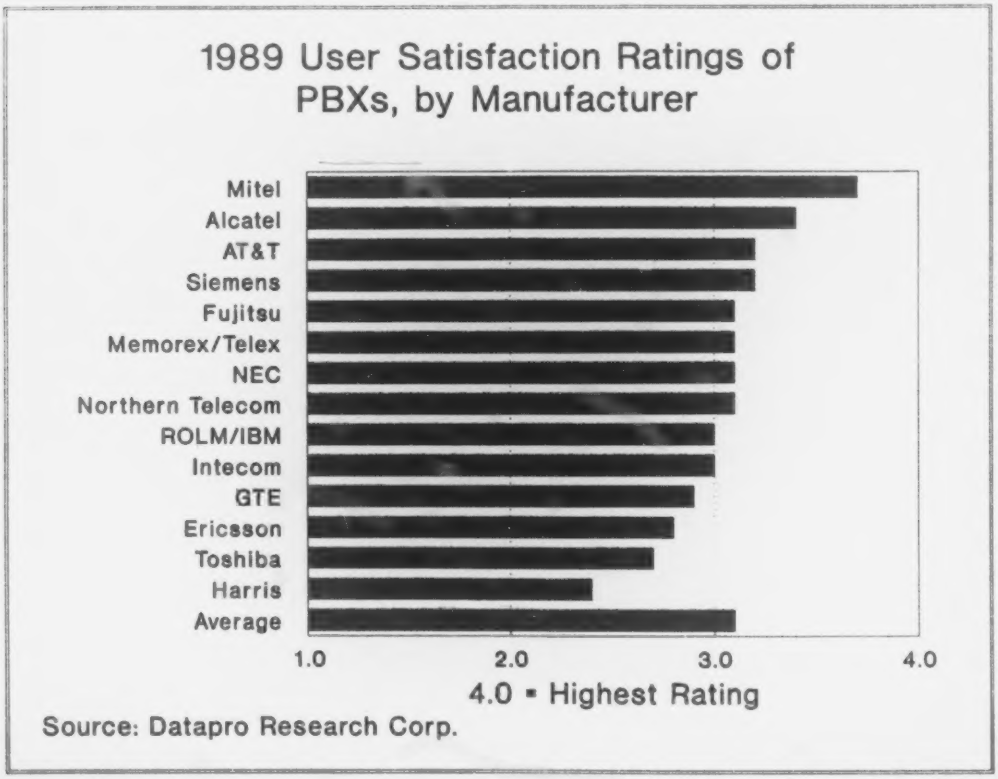
Another development that has had an impact on the market shares of PBX manufacturers, especially of the small systems, is the AT&T dumping case. To avoid the duty that certain equipment from Japan, Korea, and Taiwan has been assessed, some foreign-owned producers have set up manufacturing in the United States and will be able to avoid dumping duties as a result. A more detailed description of the proceeding is discussed in the section on foreign trade. In addition, an analysis of the effect on the key system market is discussed in the key/hybrid section of this report.

Figure 17



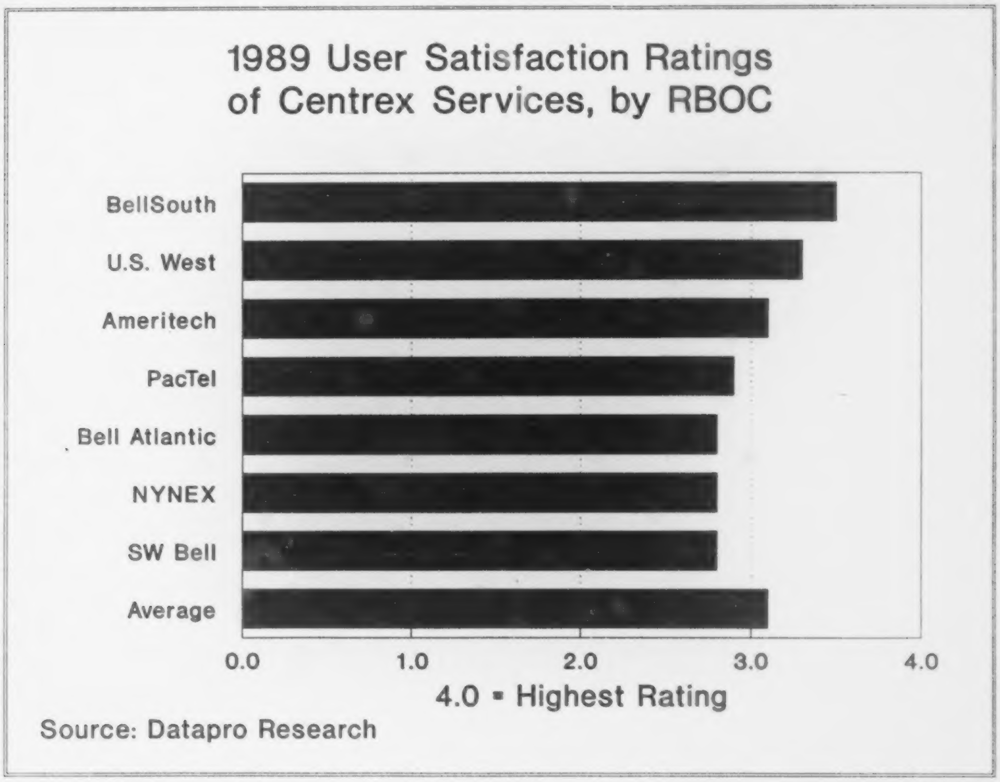
Source:
Eastern Management
Group

Figure 18



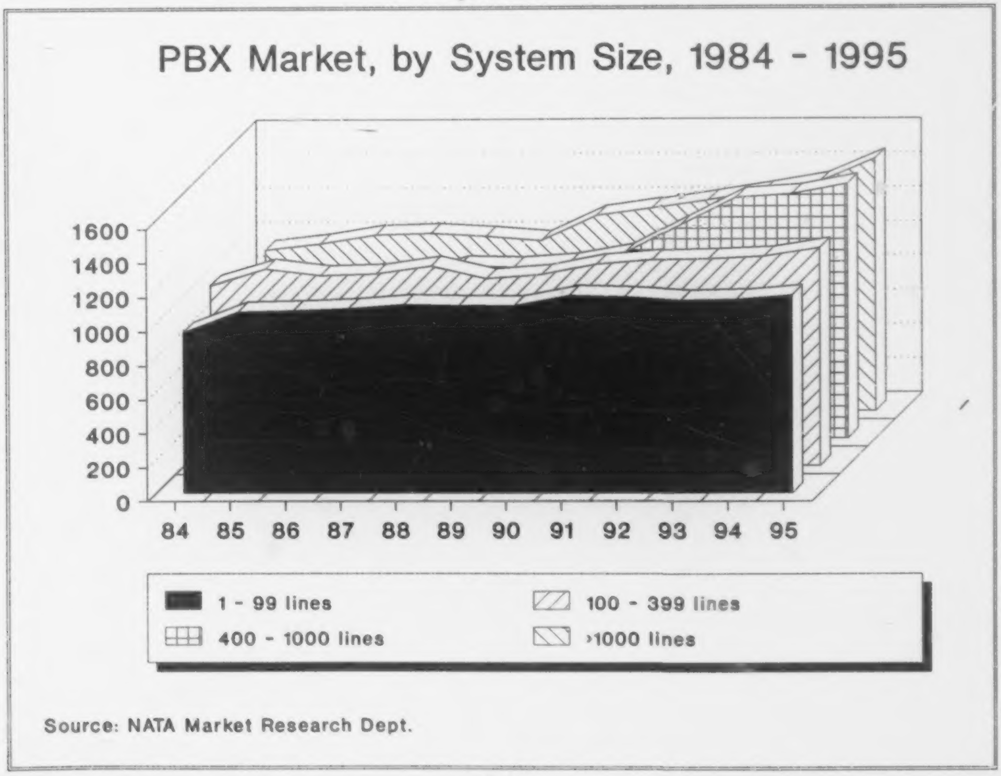
Source: Datapro Research Corp.

Figure 19



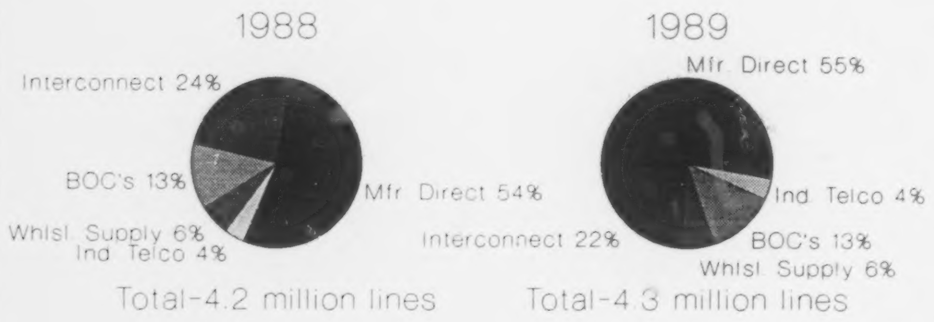
Source: Datapro Research

Figure 20



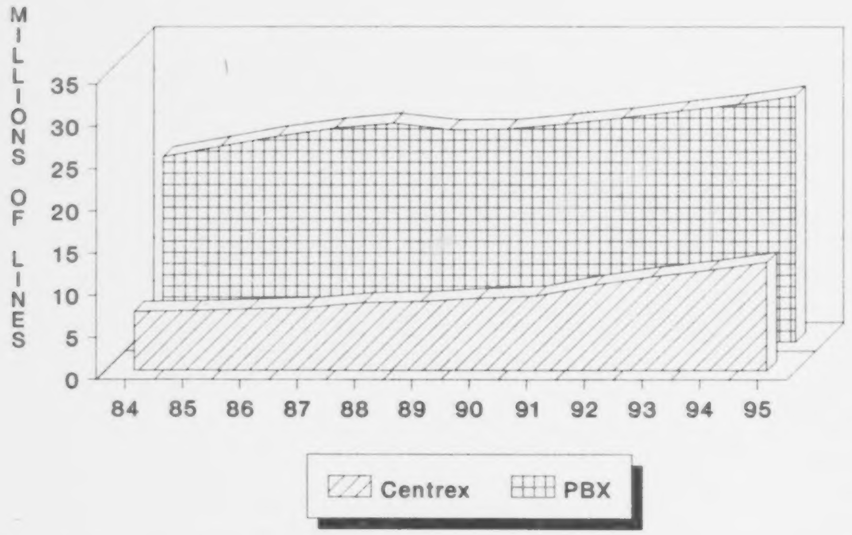
Source: NATA Market Research Dept.

Figure 21


PBX Shipments by Distribution Channel, 1988 and 1989

Source: NATA Market Research Department

Figure 22

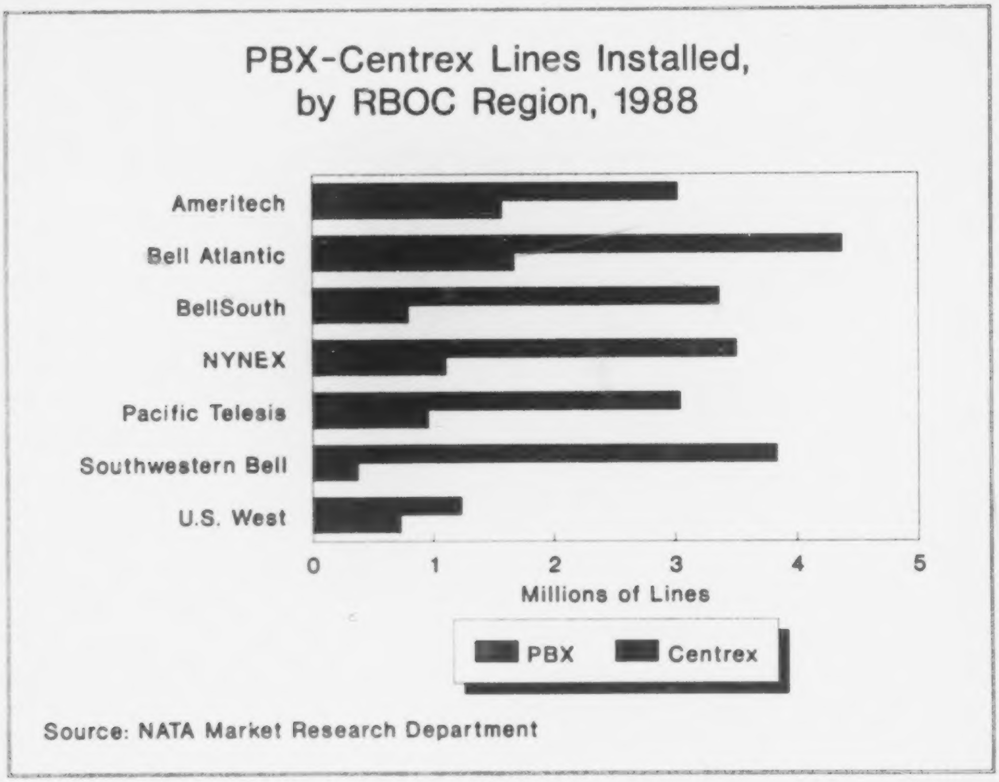

PBX-Centrex Installed Base Development

PBX Compound Growth Rate = 3.1%

Centrex Compound Growth Rate = 8.9%

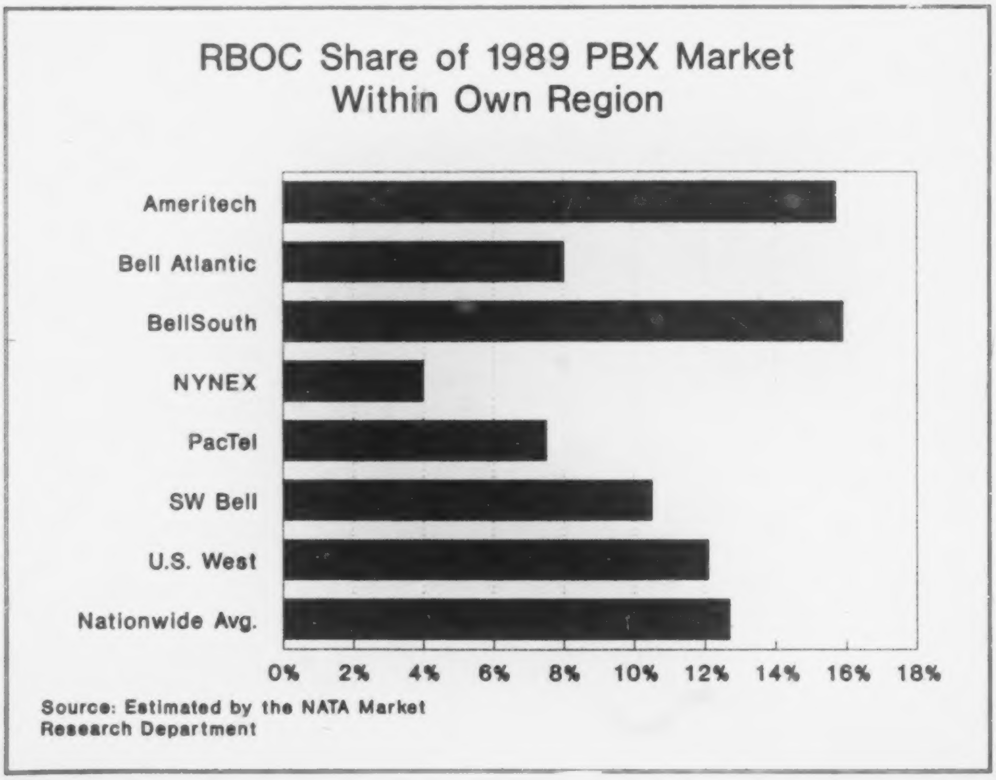
Source: NATA Market Research Department

Figure 23


PBX-Centrex Lines Installed, by RBOC Region, 1988

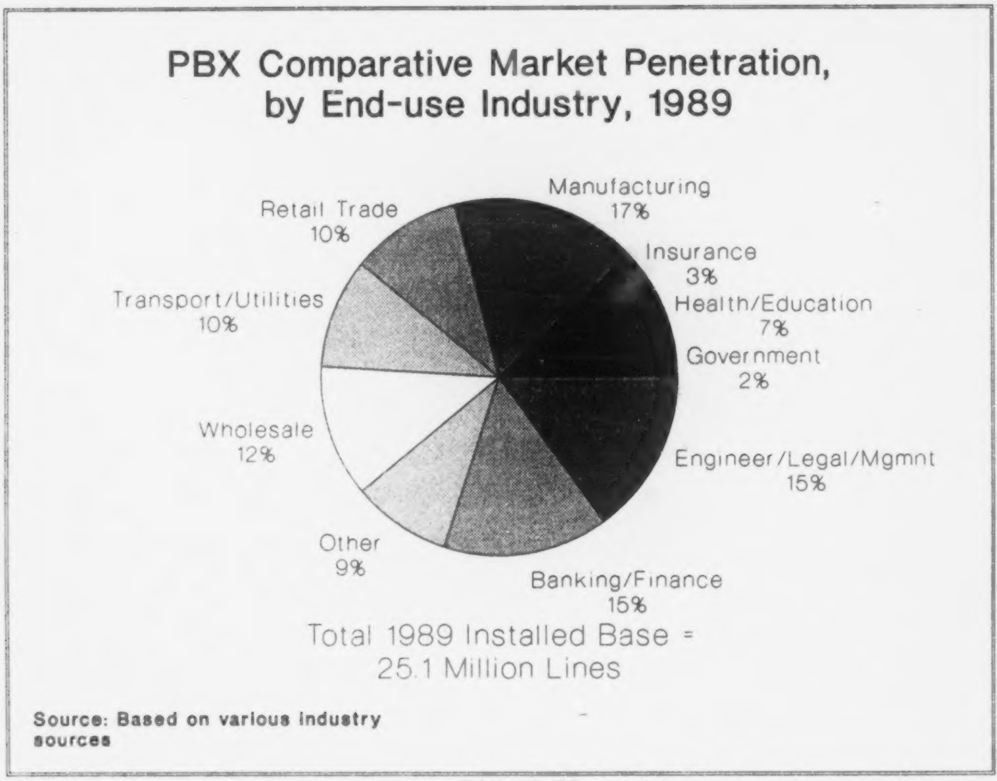
Source: NATA Market Research Department

Figure 24


RBOC Share of 1989 PBX Market Within Own Region

Source: Estimated by the NATA Market Research Department

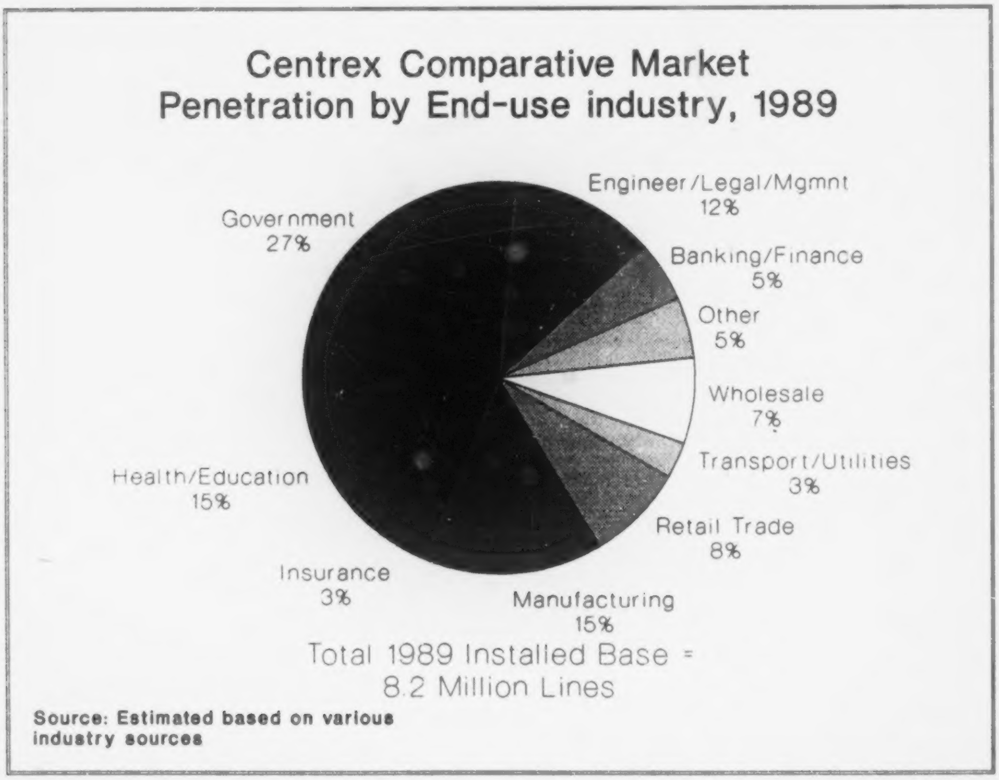
Figure 25


PBX Comparative Market Penetration, by End-use Industry, 1989

Total 1989 Installed Base = 25.1 Million Lines

Source: Based on various industry sources

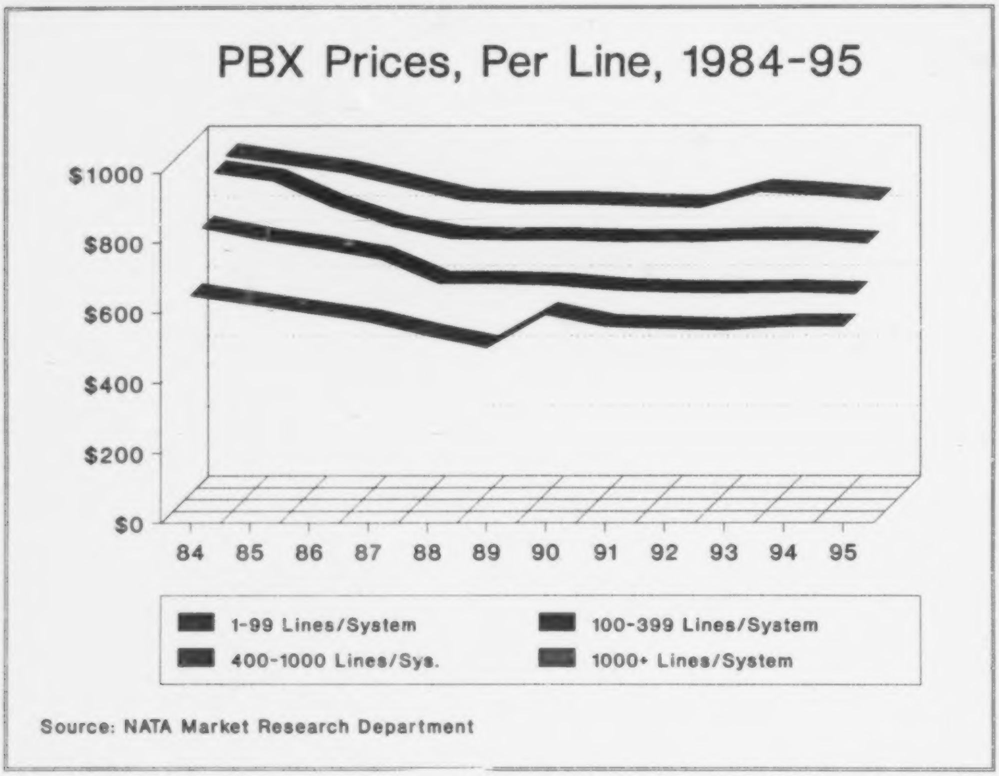
Figure 26


Centrex Comparative Market Penetration by End-use industry, 1989

Total 1989 Installed Base = 8.2 Million Lines

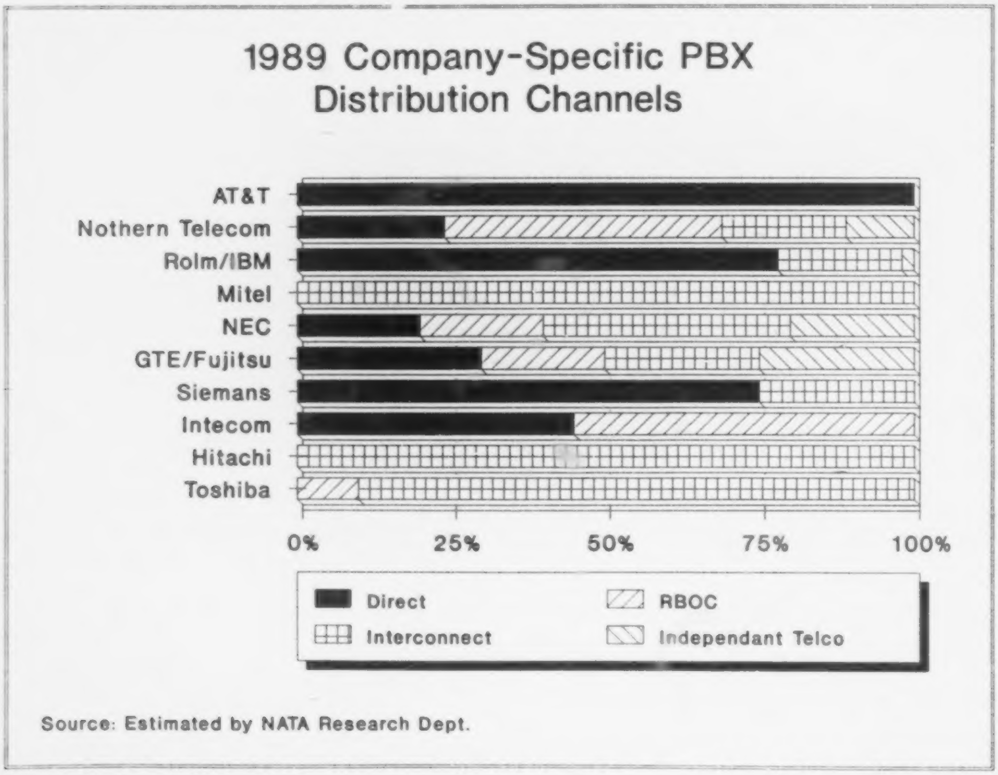
Source: Estimated based on various industry sources

Figure 27


PBX Prices, Per Line, 1984-95

Source: NATA Market Research Department

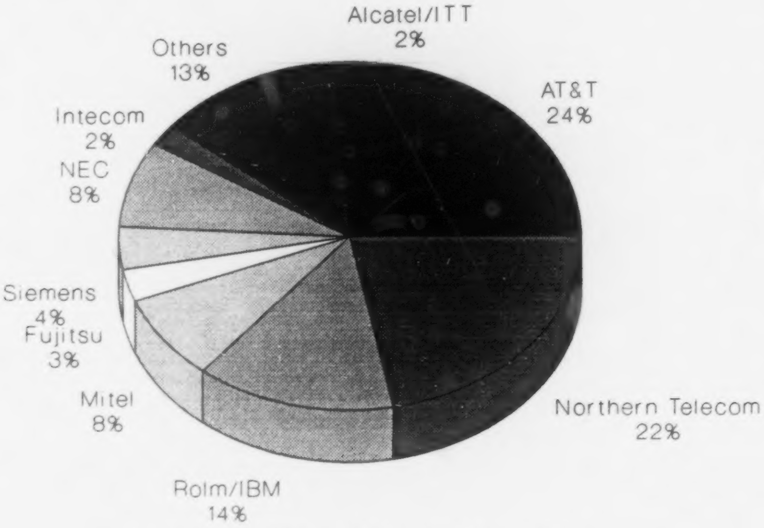
Figure 28


1989 Company-Specific PBX Distribution Channels

Source: Estimated by NATA Research Dept.

Figure 29

1989 Manufacturer Market Shares of PBX Line Shipments

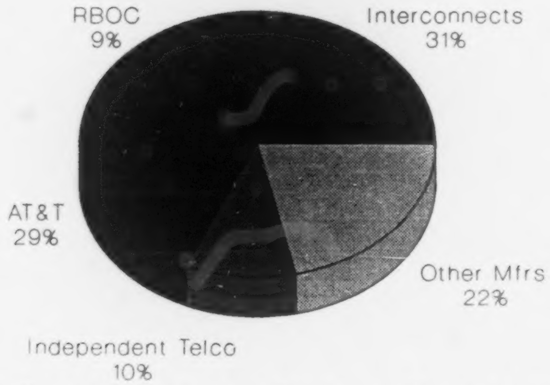


Total Market = 4,201,000 Lines

Source: NATA Research Dept.

Figure 30

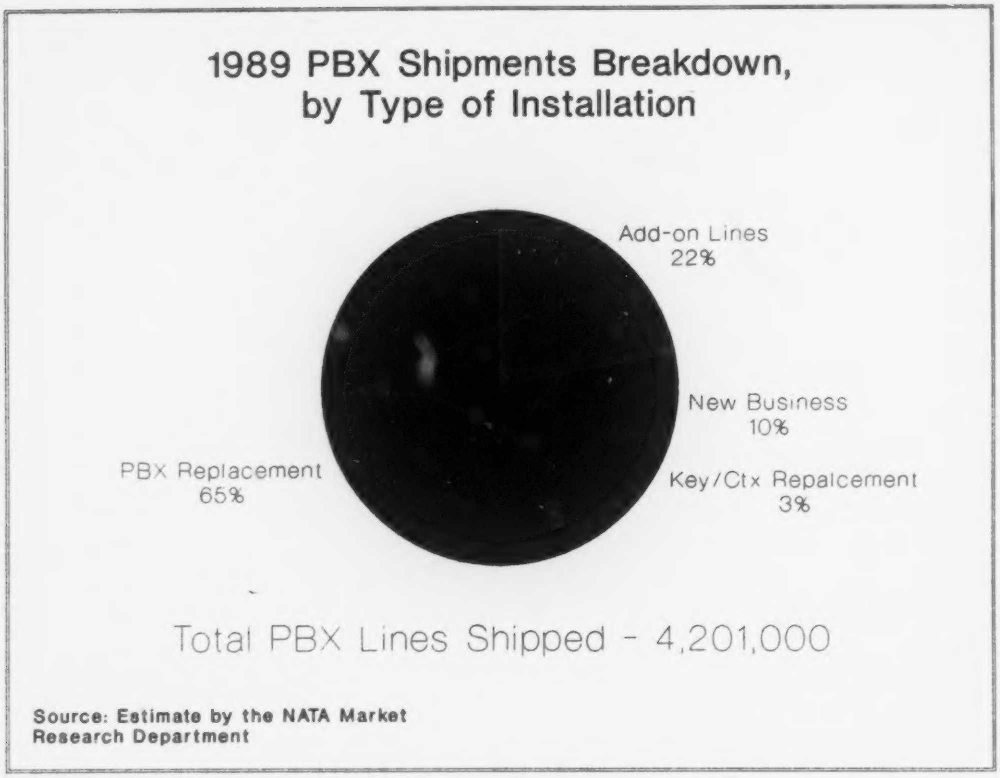
Vendor Control Over 1989 Installed PBX Customer Base



1989 Total Installed Base = 25.1 Million Lines

Source: NATA Market Research Dept.

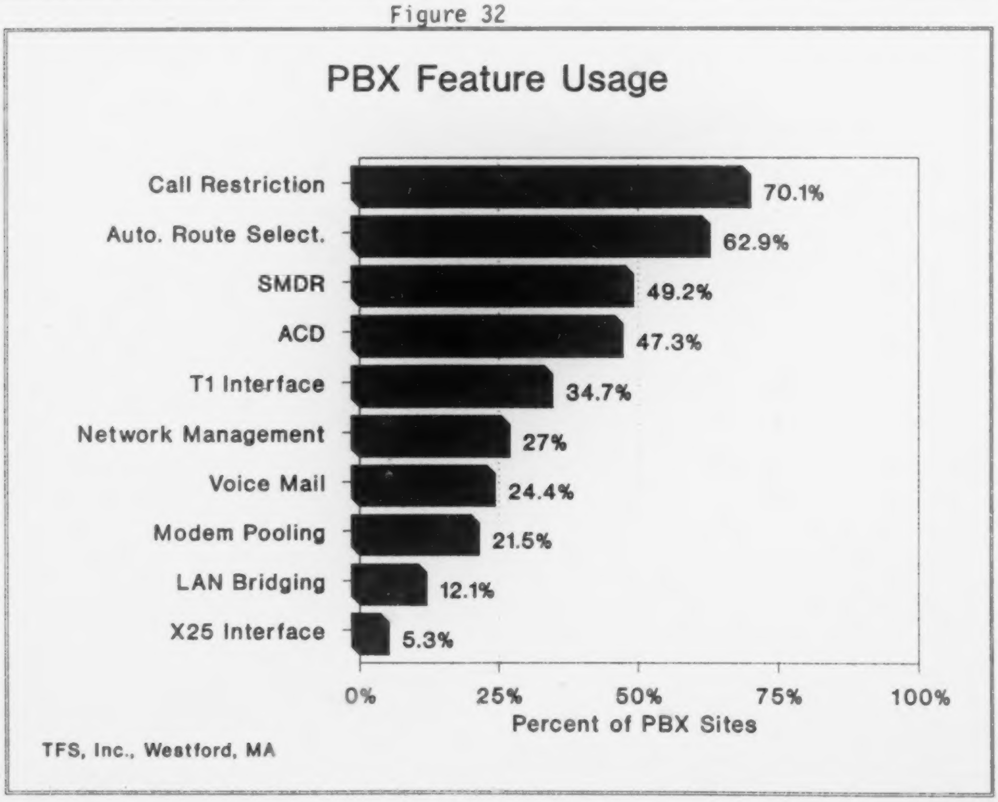
Figure 31



1989 PBX Shipments Breakdown, by Type of Installation

Source: Estimate by the NATA Market Research Department

Figure 32



PBX Feature Usage

TFS, Inc., Westford, MA

Table 21

Annual PBX Sales, by System Size, 1984-1995

	1984	1985	1986	1987	1988	1989(r)	1984-89 *CAGR Percent
1-99 Lines per System:							
Lines: thousands	948	1,069	1,076	1,086	1,110	1,102	3.1
Systems: thousands	16.3	18.4	18.5	18.7	19.1	19.0	3.1
Avg. Lines per System	58.1	58.1	58.2	58.2	58.2	58.3	
100-399 Lines per System:							
Lines: thousands	1,061	1,157	1,118	1,127	1,173	1,097	.7
Systems: thousands	6.8	7.4	7.1	7.2	7.5	7.0	.6
Avg. Lines per System	157.0	157.0	157.0	157.0	157.1	157.1	
400-100 Lines per System:							
Lines: thousands	834	907	911	919	1,011	1,004	3.8
Systems: thousands	1.3	1.4	1.4	1.4	1.6	1.6	4.2
Avg. Lines per System	644.5	644.5	644.5	644.5	644.4	644.4	
1000+ Lines per System:							
Lines: thousands	947	982	1,035	1,043	1,025	998	1.1
Systems: thousands	0.3	0.3	0.3	0.4	0.3	0.3	**
Avg. Lines per System	2,975.3	2,975.2	2,975.2	2,975.1	2,975.0	2,975.0	
Total:							
Lines: thousands	3,790	4,115	4,140	4,175	4,319	4,201	2.1
Systems: thousands	24.7	27.5	27.3	27.7	28.5	28.0	2.5
Avg. Lines per System	153.4	149.6	151.6	150.7	151.5	151.1	
Value: millions	$2,843	$3,086	$3,105	$3,050	$2,928	$2,875	0.2
Avg. price per line: dollars	$ 750	$ 750	$ 750	$ 731	$ 678	$ 679	-1.1

	1990(e)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 *CAGR Percent
1-99 Lines per System:							
Lines: thousands	1,100	1,159	1,150	1,130	1,135	1,160	1.0
Systems: thousands	18.9	19.8	19.7	19.3	19.4	20.3	1.4
Avg. Lines per System	58.3	58.4	58.4	58.5	58.5	57.3	
100-399 Lines per System:							
Lines: thousands	1,120	1,180	1,205	1,210	1,225	1,275	2.6
Systems: thousands	7.1	7.5	7.7	7.7	7.8	8.2	2.9
Avg. Lines per System	157.1	157.1	157.2	157.3	157.3	156.0	
400-100 Lines per System:							
Lines: thousands	1,025	1,082	1,250	1,410	1,430	1,490	7.8
Systems: thousands	1.6	1.7	1.9	2.1	2.2	2.4	8.4
Avg. Lines per System	644.4	644.4	644.5	644.5	644.5	643.0	
1000+ Lines per System:							
Lines: thousands	1,000	1,152	1,235	1,285	1,340	1,475	8.1
Systems: thousands	0.4	0.4	0.4	.4	.4	.5	4.6
Avg. Lines per System	2,990.0	2,992.0	2,995.0	2,995.0	2,995.0	2,985.0	
Total:							
Lines: thousands	4,245	4,573	4,840	5,355	5,130	5,400	4.9
Systems: thousands	28.9	29.4	29.7	29.7	30.2	31.6	1.8
Avg. Lines per System	151.9	156.8	162.9	169.5	170.0	170.9	
Value: millions	$2,850	$2,925	$3,100	$3,250	$3,285	$3,400	3.6
Avg. price per line: dollars	$ 649	$ 634	$ 640	$ 645	$ 640	$ 630	-0.6

(r) Revised
(e) Estimated
* Compound Annual Growth Rate
(p) Projected
** Less than .05 Percent

Source: NATA Market Research Department

Table 22

PBX Installed Base and Annual Sales for the Top 30 Metropolitan Areas, 1985, 1990 and 1995

City	PBX Installed Base In No. of Systems			Annual PBX Shipments In No. of Systems		
	1985	1990	1995	1985	1990	1995
Atlanta	1,702	2,052	2,252	255	308	338
Baltimore	1,416	1,554	1,609	212	233	241
Boston	3,357	4,012	4,346	503	601	651
Chicago	6,698	7,359	7,754	1,004	1,103	1,163
Cincinnati	1,162	1,320	1,384	174	198	208
Cleveland	1,815	1,955	2,004	272	293	300
Columbus	881	1,028	1,099	132	154	164
Dallas/Ft. Worth	3,157	4,189	4,561	473	628	684
Denver	1,655	2,033	2,291	248	304	343
Detroit	3,002	3,333	3,757	450	499	563
Houston	3,118	3,051	3,123	467	455	502
Indianapolis	950	1,088	1,135	142	163	170
Kansas City	1,229	1,381	1,450	184	207	217
Los Angeles	7,469	8,371	8,922	1,120	1,255	1,338
Miami	1,473	1,649	1,748	220	247	262
Milwaukee	1,323	1,447	1,514	198	217	227
Minneapolis/St. Paul	2,311	2,762	3,003	346	414	450
New Orleans	1,027	1,116	1,169	154	167	175
New York	7,395	7,917	8,237	1,109	1,187	1,235
Oklahoma City	739	870	946	110	130	141
Phoenix	1,223	1,660	1,932	183	249	289
Pittsburgh	1,539	1,678	1,736	230	251	260
Portland	1,072	1,294	1,426	160	194	213
Philadelphia	3,552	3,916	4,086	532	587	612
St. Louis	1,989	2,231	2,337	298	334	350
San Diego	1,131	1,416	1,575	169	212	236
San Francisco	2,757	3,137	3,373	413	470	505
San Jose	1,095	1,414	1,583	164	212	237
Seattle	1,351	1,657	1,808	202	248	271
Washington	2,337	2,704	2,895	350	405	434

Source: NATA Market Research Department.

Table 23

PBX Shipments by Manufacturers' Distribution Channel, 1986-1989

	1986		1987		1988		1989	
	Lines (thousands)	Share (percent)	Lines (thousands)	Share (percent)	Lines (thousands)	Share (percent)	Lines (thousands)	Share (percent)
Manuf. Direct*	2,087	50.4	2,242	53.7	2,328	53.9	2,311	55.0
Interconnect	998	24.1	1,044	25.0	1,028	23.8	916	21.8
Wholesale Supply Houses	404	9.7	225	5.4	255	5.9	260	6.2
Bell Operating Co.	479	11.6	518	12.4	544	12.6	542	12.9
Independent Operating Companies	172	4.2	146	3.5	164	3.8	172	4.1
Total	4,140	100.0	4,175	100.0	4,319	100.0	4,201	100.0

* Includes wholly-owned distributor networks.

Source: NATA Market Research Department

Table 24

PBX-Centrex* Installed Base Development, 1984-1995

	1984	1985	1986	1987	1988	1989	**CAGR
	Thousands of Lines						Percent
1-99 Lines per System:							
PBX	5,484	5,794	5,851	6,077	6,085	5,985	1.8
Centrex	925	935	957	1,129	1,214	1,325	7.5
100-399 Lines per System:							
PBX	6,142	6,489	6,826	7,343	7,510	7,292	3.5
Centrex	827	840	834	902	972	998	4.0
400-1000 Lines per System:							
PBX	4,825	5,099	5,607	5,824	5,956	6,035	4.6
Centrex	1,426	1,440	1,544	1,441	1,550	1,495	.9
1000+ Lines per System:							
PBX	5,483	5,794	6,095	6,070	6,346	5,833	1.2
Centrex	3,875	3,925	4,020	4,053	4,364	4,405	2.6
TOTAL:							
PBX	21,934	23,176	24,379	25,320	25,897	25,145	2.8
Centrex	7,053	7,140	7,355	7,525	8,100	8,223	3.1

	1990	1991	1992	1993	1994	1995	**CAGR
	Thousands of Lines						Percent
1-99 Lines per System:							
PBX	5,860	6,081	6,328	6,530	6,680	6,830	3.1
Centrex	1,424	1,514	1,745	1,875	2,055	2,290	10.1
100-399 Lines per System:							
PBX	7,308	7,332	7,412	7,505	7,590	7,700	1.1
Centrex	1,036	1,099	1,205	1,490	1,562	1,635	9.6
400-1000 Lines per System:							
PBX	6,048	6,166	6,323	6,625	6,880	7,300	3.8
Centrex	1,505	1,515	1,545	1,680	1,815	1,960	5.4
1000+ Lines per System:							
PBX	5,984	6,232	6,486	6,748	7,020	7,370	4.3
Centrex	4,651	4,752	5,700	6,160	6,530	7,050	8.7
TOTAL:							
PBX	25,200	25,811	26,549	27,408	28,170	29,200	3.0
Centrex	8,616	8,880	10,195	11,205	11,962	12,935	8.5

* Revised from Previous Reports

** Compound Annual Growth Rate

Source: NATA Market Research Department

Table 25

PBX-Centrex Lines in Place, by Regional Bell Operating Company, 1986-1990

	1986	1987	1988	1989	1990(e)	CAGR*
	Thousands of Lines					Percent
Ameritech						
PBX	2,857	2,986	3,002	3,025	3,175	2.7
Centrex	1,020	1,185	1,350	1,575	1,720	14.0
Bell Atlantic						
PBX	4,085	4,269	4,390	4,375	4,469	2.3
Centrex	1,375	1,480	1,550	1,675	1,810	7.1
BellSouth						
PBX	3,120	3,406	3,485	3,365	3,475	2.7
Centrex	450	675	785	795	810	15.8
NYNEX						
PBX	3,320	3,530	3,610	3,505	3,575	1.9
Centrex	957	1,027	1,075	1,105	1,195	4.5
PACTEL						
PBX	3,025	3,067	3,150	3,040	3,173	1.2
Centrex	875	935	950	960	960	2.3
SW Bell						
PBX	3,300	3,420	3,575	3,835	4,076	5.4
Centrex	250	300	325	375	450	15.8
U.S. West						
PBX	1,990	2,045	1,936	1,234	1,485	-7.0
Centrex	477	596	675	732	990	20.0
TOTAL						
PBX	21,697	22,723	23,148	22,379	23,428	1.9
Centrex	5,404	6,198	6,710	7,217	7,935	8.1

(e) Estimated
* Compound Annual Growth Rate

Table 26

PBX-Centrex Penetration, by Industry, 1989

	Percent of Installed PBX Lines	Percent of Installed Centrex Lines
	- - - - - - Percent	- - - - - - -
Banking/Finance	15	5
Engineering/Legal/Management	15	12
Government	2	27
Health/Education	7	15
Insurance	3	3
Manufacturing	17	15
Retail Trade	10	8
Transportation/Utilities	10	3
Wholesale	12	7
Other	9	5
Total	100	100

Source: Gartner Group

Table 27

PBX Per Line Prices, by System Size, 1984-1995

System	1984	1985	1986	1987	1938	1989(e)	CAGR*
	- - - - - - - -	- dollars	per line	- - -	- - -	- - -	(Percent)
1-99 Lines per System	650	625	600	575	535	500	-1.6
100-399 Lines per System	810	775	750	720	650	650	-4.3
400-1000 Lines per System	935	910	835	780	745	740	-4.6
1000+ Lines per System	950	925	900	860	820	810	-2.8
Average	750	750	750	731	678	679	-6.5

System	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	CAGR*
	- - - - - - - -	- - - - -	dollars per	line - -	- - - -	- - - -	(Percent)
1-99 Lines per System	595	560	555	550	560	560	-1.2
100-399 Lines per System	645	630	625	623	625	620	-0.8
400-1000 Lines per System	740	735	735	740	740	730	-0.3
1000+ Lines per System	810	805	800	845	835	820	2.5
Average	649	634	640	645	640	630	-0.6

(e) Estimated
* Compound Annual Growth Rate
(p) Projected

Source: NATA Market Research Department

Table 28

Estimated Revenue for Major PBX Manufacturers, 1986-1989

	1986	1987	1988	1989(e)
	- - - - - - - - -	millions of dollars	- - - - - - - - -	
AT&T	460	450	400	390
Northern Telecom	385	345	335	340
IBM/ROLM	265	265	300	290
NEC	150	145	135	130
Mitel	110	90	100	110
Siemens	90	85	95	100
Intecom/Wang	45	40	35	30
Fujitsu	25	60	65	60

(e) Estimated by NATA Market Research Department.

Source: Washington Post; August 11, 1989

Table 29

1989 PBX Manufacturer Market Shares, by Lines Shipped, by System Size

(in percent)

	1-99	100-399	400-999	1000+	Total
AT&T	19	25	25	27	24
Northern Telecom	25	24	19	25	22
ROLM/IBM	8	12	17	20	14
Mitel	18	8	2	3	8
NEC	6	8	10	8	8
Siemens	6	5	2	3	4
Fujitsu	*	5	6	1	3
Alcatel/ITT	3	5	1	*	2
Intecom/Wang	*	*	*	10	2
Others	14	8	16	3	13
Total	100	100	100	100	100

* Less than 1 percent

Source: NATA Market Research Department

Key/Hybrid Telephone System Market

Introduction

Key telephone systems are multi-line business communications systems providing users with shared access to a group of external telephone lines through buttons or keys located on the telephone set. Typically, each key is associated with a specific outside line, and that line's number appears on the key. When a user presses a key and lifts the telephone receiver off-hook, a circuit is completed and the user receives a dial tone from the telephone company's central office (CO). The buttons on a key telephone generally light up and flash to indicate the status of the line to which the phone is connected. For example, an unlit button indicates an idle line; a slow flash indicates an incoming call; a fast flash indicates a call on hold; and a steady light indicates the line is in use. This type of network access is referred to as direct line termination, as each incoming line is connected directly to a specific key on the telephone set.

Key systems primarily provide voice communications for small to medium-sized offices--those requiring from 2 to 120 station sets. These systems provide intra-office communications links (intercom), shared access to the public switched telephone network and long-distance networks, and limited office-automation functions (such as call accounting).

Key systems can serve either as stand-alones or as adjuncts to larger PBX systems or centrex offerings. As a stand-alone, the key/hybrid, acting as the primary telecommunications system within a small business or branch office, is connected directly to the local telephone company central office. As an adjunct, the key system is installed alongside a PBX or centrex system. This configuration provides users with access to those switching systems' enhanced features and affords greater ease of use than standard single-line telephone sets. About 30 percent of the installed base of key/hybrid systems are used in conjunction with either a PBX or with centrex.

Key systems have evolved from electromechanical devices to electronic systems employing solid state integrated circuits and microprocessors. Introduced in the late 1970s, hybrid key systems are the most recent variety. The designation "hybrid" refers to the key system's ability to provide direct-line-terminated, one-button-per-line network access typical of traditional key systems, or the "dial 9" pooled access characteristic of PBX systems--with some able to provide both types of network access simultaneously to different station sets.

Typical features of a modern hybrid key system include call restriction, system speed dialing, system administration, night service, emergency power, and station message detail recording. At the other end of the spectrum, key systems without a KSU (key service unit) are becoming increasingly popular, particularly in small businesses, due to their ease of installation and their decentralized configuration.

As the implementation of ISDN progresses, more and more manufacturers offer end-to-end digital key systems to complement their analog product offerings. One reason is that all-digital systems support modemless data communications capability. In addition, wireless and cordless key systems are attracting attention. With wireless systems, the station sets are connected to the KSU by radio waves rather than by wire. With cordless units, the station sets themselves have cordless handsets that communicate with the station base unit. AT&T introduced a cordless key system at year-end 1989 which has attracted considerable attention.

Market Review

The key system market decreased from just over 4.2 million stations valued at over $1.0 billion in 1984 to just under 4.2 million stations valued at $955 million in 1985 (see Table 30). Since then the market has increased very slowly, reaching 4.3 million stations valued at $995 million in 1989 (see Fig. 33). It is anticipated that the growth of the market will accelerate somewhat in the next few years and amount to 5.8 million stations valued at $1.3 billion in 1995. The market is currently characterized by a relatively large number of suppliers competing for market share. Profit margins have been slim, so vendors of key systems are beginning to market the products creatively. One aspect of this creativity has been the growth in key systems used in conjunction by centrex, especially with smaller users. Growth of the market for the smallest line-size segment--1 to 24 stations--is expected to increase the fastest between now and 1995 (see Fig. 34).

One of the dramatic developments of the past year has been the increase in Northern Telecom's share of the key system market. With Norstar, a feature rich, user friendly product, and aggressive pricing and marketing techniques, Northern Telecom has grown from an also-ran to a major player with 7 percent of the market in 1989. Part of Northern's success is due to its distribution strategy. The company has signed some type of distribution agreement with virtually every RBOC as well as with many independents. In addition, it has a direct sales force for national accounts, and utilizes interconnects for the balance of its distribution requirements. The company's stated plan is to have over 20 percent of the market within the next several years.

In general, manufacturers of key systems are increasingly selling directly to end users by acquiring interconnect companies. TIE alone has acquired over 40 interconnect companies in the last several years. As shown in Table 31, manufacturers' direct sales (including wholly owned distribution networks) increased from 1.3 million stations in 1986 (31.1 percent of the market) to 1.6 million stations in 1989 (36.5 percent of the market) (see Fig. 35). Sales by independent interconnects decreased from just under 1.9 million stations (44.9 percent of the market) to 1.8 million stations (43.0 percent of the market) during the same time period. Overall, distribution through RBOCS, wholesale supply houses, and independent telephone companies remained relatively stable from 1988 to 1989.

Installed Base

The installed base of key and hybrid key systems in the U.S. increased from 27.6 million stations in 1984 to 29.6 million stations in 1989 and is expected to increase to 30.0 million stations by 1995 (see Table 32 and Fig. 36). In terms of systems, the installed base increased from 5.1 million in 1984 to 5.3 million in 1989 and is expected to amount to 5.1 million in 1995.

As for industry penetration, the single most significant market for key systems is the engineering/legal/management services market, accounting for 16 percent of all key systems sold in 1989 (see Table 33 and Fig. 37). Health/education and retail markets were close seconds, each with 15 percent of the market.

AT&T Dumping Case

On December 28, 1988, a petition was filed with the U.S. International Trade Commission (ITC) and the U.S. Department of Commerce (Commerce) by AT&T Co. and Comdial Corp. alleging that U. S. manufacturers of small telephone systems (principally key systems) were being injured by imports of those products from Japan, South Korea, and Taiwan being sold in the United States at less than fair value, *i.e.*, dumped. In the petition, AT&T and Comdial argued that the scope of the investigation should include all telephone systems having between 2 and 256 nonblocking ports or up to 100 internal lines. For AT&T's products, this includes all key/hybrid systems and AT&T's System 25 PBX.

The final dumping margins (margins of underselling) set for Japanese companies were 136.77 percent for Toshiba, 178.93 percent for Matsushita, and 157.85 percent for all other Japanese producers. With respect to Taiwanese producers, Commerce set a dumping margin of 129.73 percent for Nitsuko and a margin of 0.00 for Sun Moon Star and for all other Taiwanese producers. For Korean companies, Commerce set dumping margins of 9.33 percent for Samsung, 6.09 percent for Goldstar, and 7.79 percent for all other Korean producers.

Overall prices for small business telephone systems have increased somewhat--perhaps by as much as 5 to 10 percent in some cases. For some manufacturers this increase in price has been necessary to cover additional expenses associated with adjusting to the outcome of the case, *i.e.*, either the additional costs incurred in shifting production to a location not subject to dumping duties or the extra costs of the dumping duties themselves. Depending on the specific dumping margin and financial resources, individual companies have reacted in different ways.

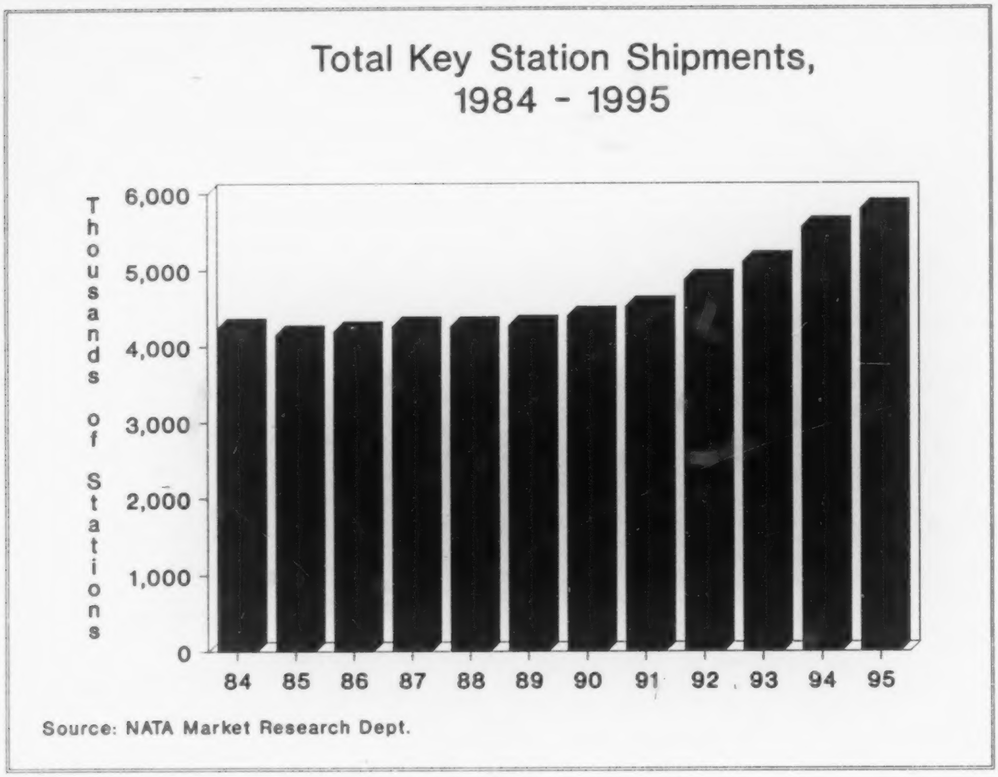
Toshiba has already expanded its manufacturing facility in Irvine, California, and Matsushita has moved its production facilities to Peachtree City, Georgia. Other Japanese suppliers forced to pay the 157.85 percent dumping margins have been adversely affected to a significant degree. With the exception of NEC, which has a facility in Irving, Texas, and Iwatsu, which has one facility in Carlstadt, New Jersey, and another in Charlotte, North Carolina, most other Japanese producers--mainly smaller manufacturers--have lost market share.

Manufacturers not directly impacted by the outcome *i.e.*, domestic producers and producers in nonsubject countries such as France and Germany, will likely take advantage of this situation and, at least in the short term, increase prices somewhat while still attempting to increase market share at the expense of the affected firms. The idea of price stability has come as welcome news for much of the industry, which has been experiencing razor-thin profit margins. Even the distributor community (except those distributors that handle the severely impacted products) are taking advantage of a strengthening of prices.

However, prices will begin to fall again as the companies adapt to a changed environment. The major long-term effect will be a redistribution of the market among the major players (see Table 34 and Fig. 38 for anticipated shifts in market share). Likely market share winners will be AT&T, Comdial, Northern Telecom, Cortelco (ITT/Alcatel), Sun Moon Star, Executone (which is shifting production to the Dominican Republic), and a few others. Others will fight for the remainder of the market.

Another effect could be an increase in the replacement rate of the installed base. As foreign manufacturers adjust by moving manufacturing to countries not affected by the dumping order, they are moving only newer generation products. The result is that adds, moves, and changes for older version products in the installed base will become significantly more costly. This will induce many customers to replace their systems.

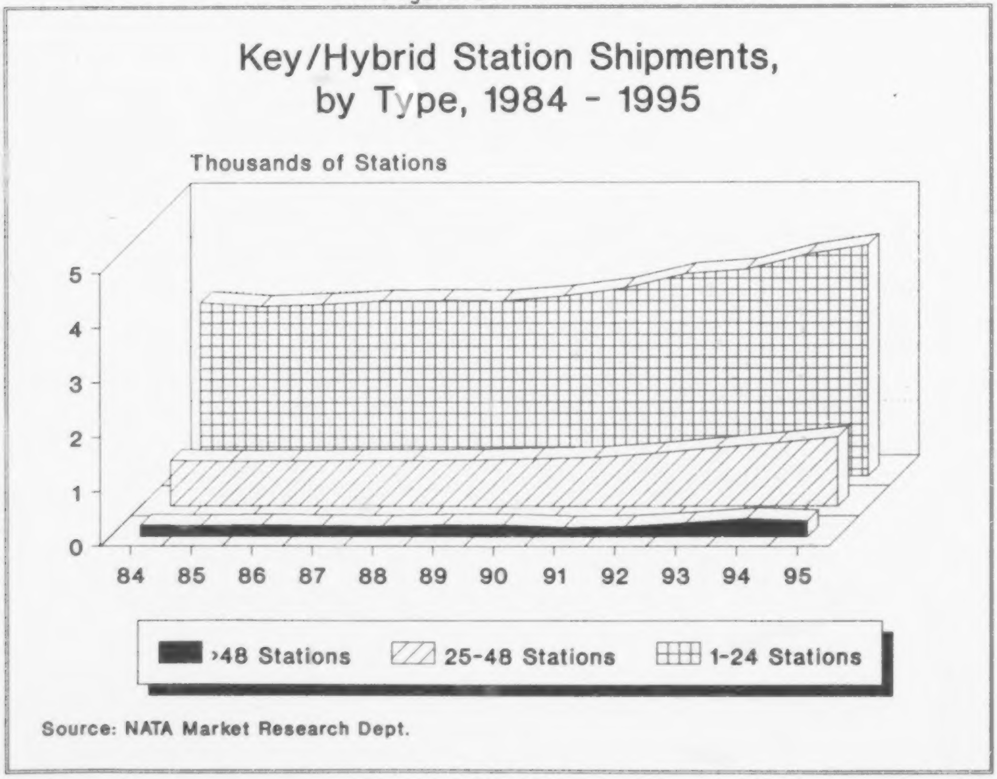
Figure 33



Total Key Station Shipments, 1984 - 1995

Source: NATA Market Research Dept.

Figure 34

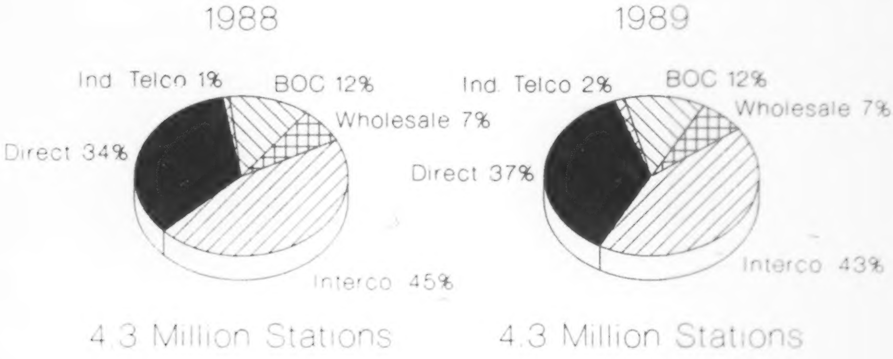


Key/Hybrid Station Shipments, by Type, 1984 - 1995

Source: NATA Market Research Dept.

Figure 35

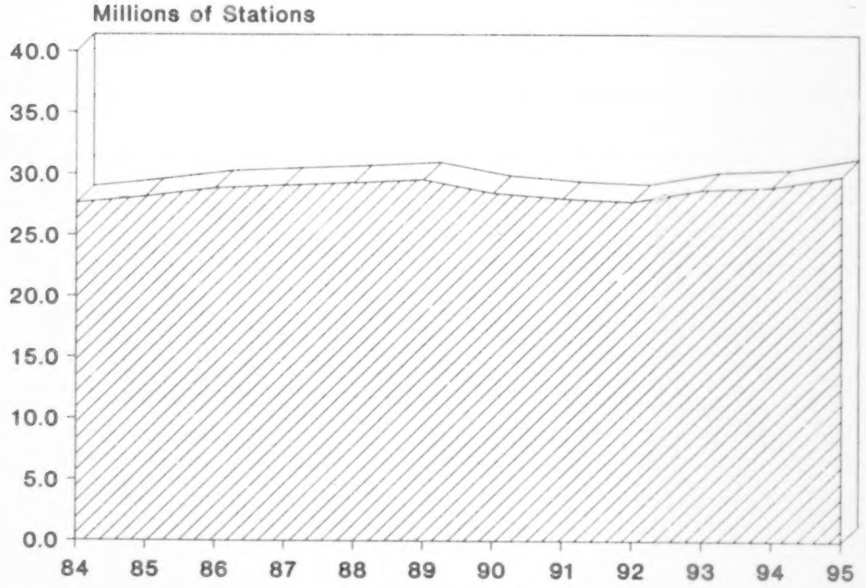
Key/Hybrid Shipments, by Distribution Channel, 1988 and 1989



Source: NATA Market Research Department

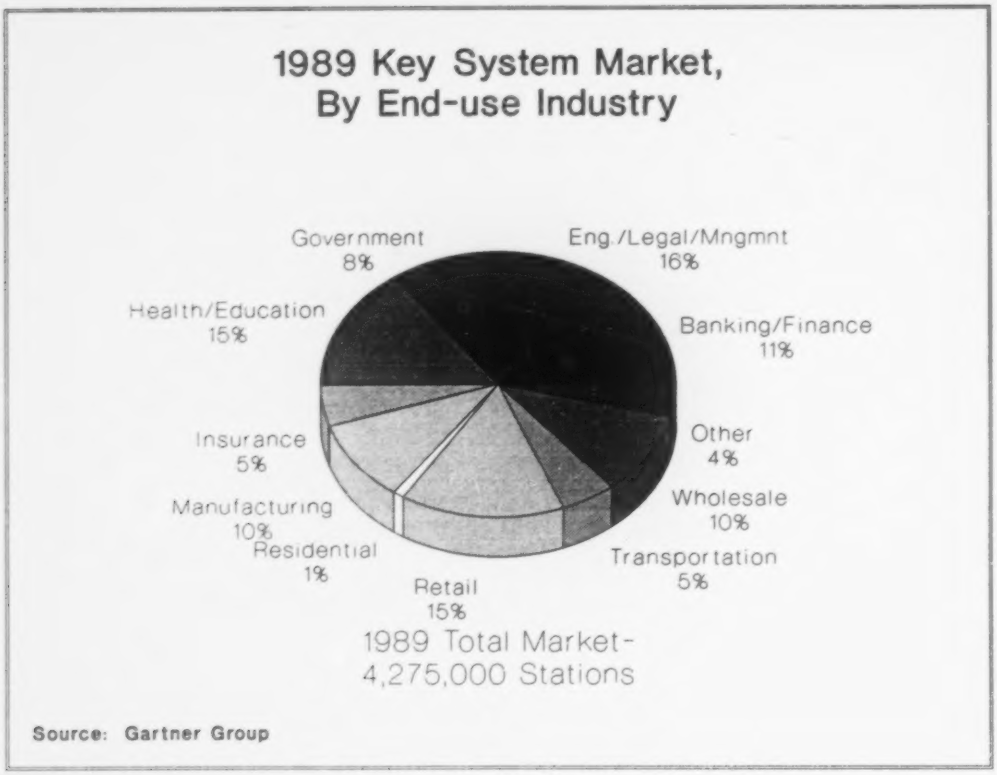
Figure 36

Key/Hybrid Installed Base, 1984-95



Source: NATA Market Research Department

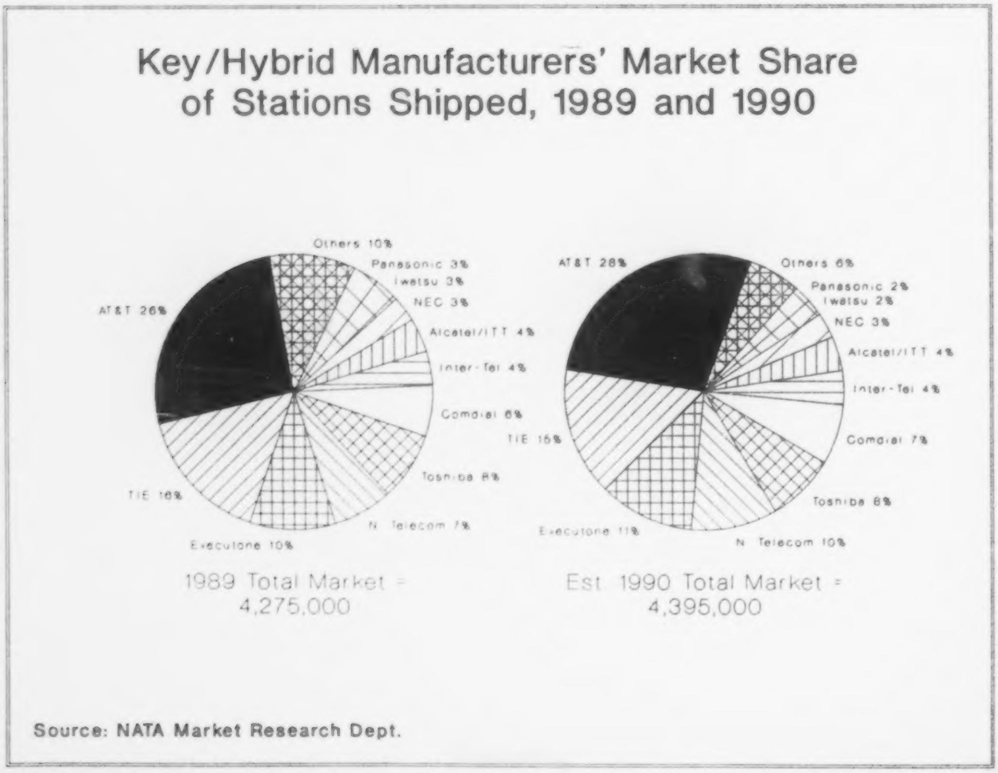
Figure 37



1989 Key System Market, By End-use Industry

Source: Gartner Group

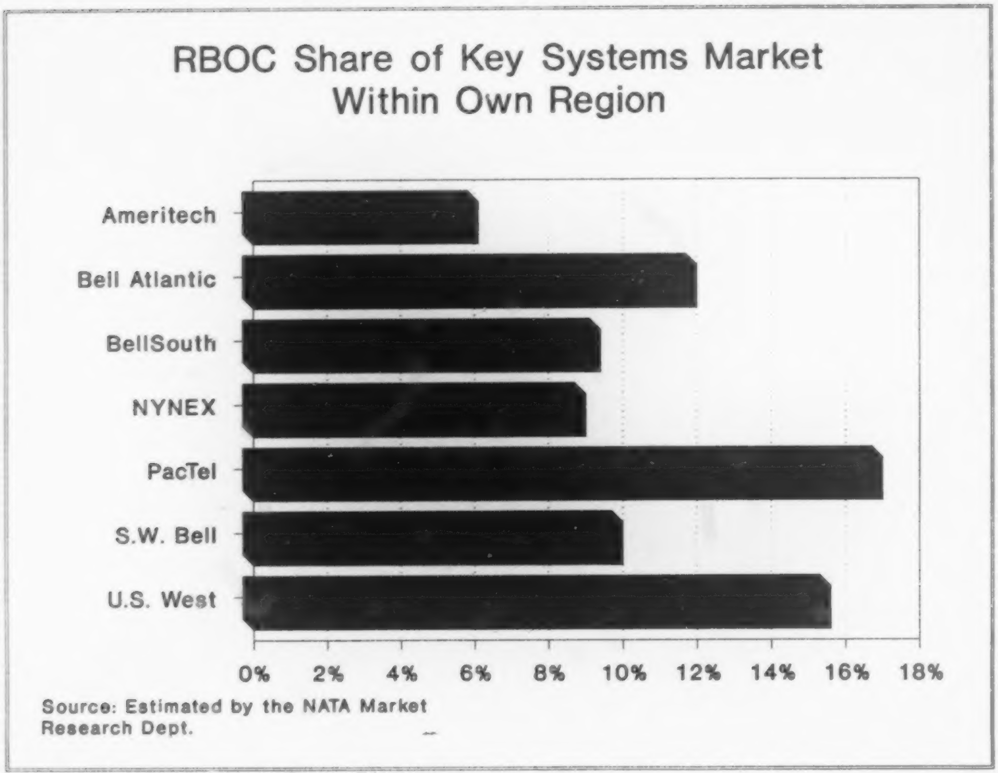
Figure 38



Key/Hybrid Manufacturers' Market Share of Stations Shipped, 1989 and 1990

Source: NATA Market Research Dept.

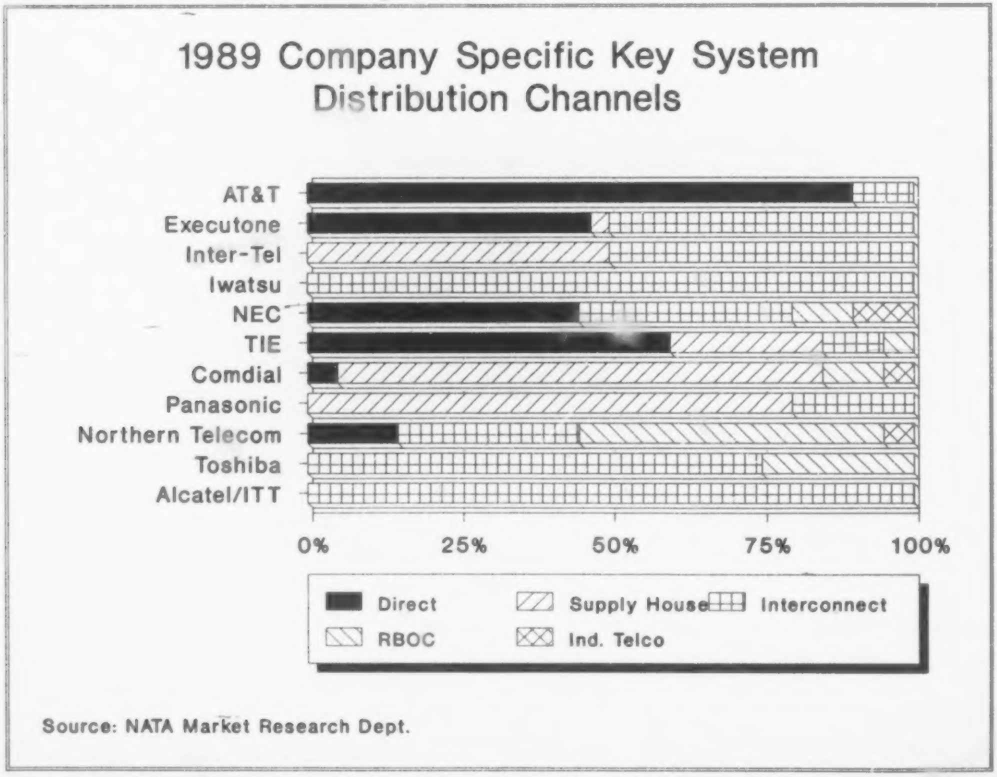
Figure 39



RBOC Share of Key Systems Market Within Own Region

Source: Estimated by the NATA Market Research Dept.

Figure 40

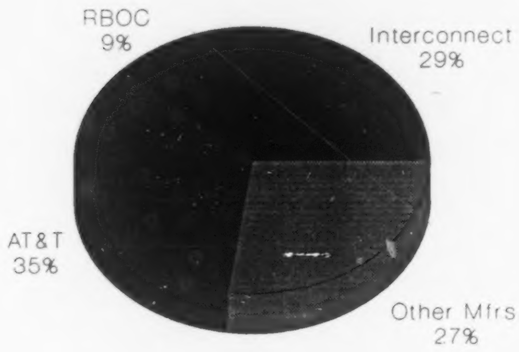


1989 Company Specific Key System Distribution Channels

Source: NATA Market Research Dept.

Figure 41

Vendor Control of the 1989 Key/Hybrid Installed Base

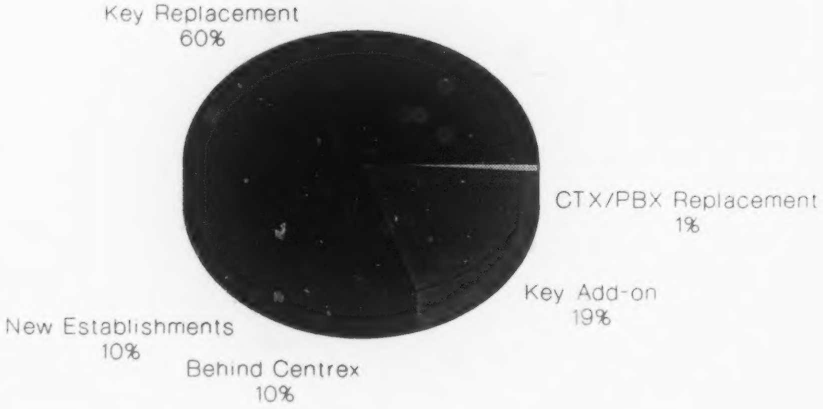


1989 Total Installed Base = 29.6 Million Stations

Source: NATA Market Research Dept.

Figure 42

1989 Key/Hybrid Shipments Breakdown, by Type of Installation



Source: NATA Market Research Dept.

Table 30

Annual Key Telephone Systems Market, 1984-1995

	1984	1985	1986	1987	1988	1989	*CAGR Percent
1-24 Stations per System:							
Stations: thousands	3,180	3,113	3,149	3,209	3,214	3,207	.2
Systems: thousands	432.9	4[illegible].7	433.9	436.6	440.4	440.4	.3
Avg. Stations per System	7.3	[illegible].3	7.3	7.3	7.3	7.3	
25-48 Stations per System:							
Stations: thousands	848	[illegible]30	840	845	846	851	.1
Systems: thousands	28.8	28.2	28.5	28.6	28.6	28.3	-.4
Avg. Stations per System	29.4	29.4	29.5	29.5	29.6	30.0	
49+ Stations per System:							
Stations: thousands	212	207	210	205	200	217	.5
Systems: thousands	4.2	4.1	4.2	4.1	4.0	4.3	.5
Avg. Stations per System	50.2	50.2	50.2	50.2	50.1	50.3	
Total:							
Stations: thousands	4,240	4,150	4,199	4,259	4,260	4,275	.2
Systems thousands	465.9	456.0	466.6	469.3	473.0	473.0	.3
Avg. Stations per System	9.1	9.1	9.0	9.1	9.0	9.0	
Value: $ millions	$1,039	$ 955	$ 957	$ 960	$ 965	$ 995	-1.0

	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	*CAGR Percent
1-24 Stations per System:							
Stations: thousands	3,296	3,439	3,701	3,781	4,059	4,230	5.1
Systems: thousands	446.3	463.3	493.7	514.0	558.4	574.7	5.1
Avg. Stations per System	7.4	7.4	7.5	7.4	7.3	7.4	
25-48 Stations per System:							
Stations: thousands	879	905	974	1,073	1,168	1,275	7.7
Systems: thousands	29.3	30.2	32.6	35.9	39.1	42.5	7.7
Avg. Stations per System	30.0	30.0	29.9	29.9	29.9	30.0	
49+ Stations per System:							
Stations: thousands	220	181	195	256	333	290	5.7
Systems: thousands	4.4	3.6	3.9	5.1	6.6	5.8	5.7
Avg. Lines per System	50.2	50.0	50.1	50.2	50.2	50.2	
Total:							
Stations thousands	4,395	4,525	4,870	5,110	5,560	5,795	5.7
Systems: thousands	480.0	497.1	530.2	555.0	604.1	623.0	5.4
Avg. Stations per Systems	9.1	9.1	9.2	9.2	9.2	9.3	
Value: $ millions	1,050	1,100	1,125	1,175	1,250	1,275	4.0

(e) Estimated
* Compound Annual Growth Rate
(p) Projected

Source: NATA Market Research Department

Table 31

Key & Hybrid Shipments by Manufacturers' Distribution Channel, 1986-1989

	1986		1987		1988		1989	
	Stations (thousands)	Share (percent)	Stations (thousands)	Share (percent)	Stations (thousands)	Share (percent)	Stations (thousands)	Share (percent)
Manuf. Direct	1,307	31.1	1,419	33.3	1,457	34.2	1,560	36.5
Interconnect	1,877	44.7	1,913	44.9	1,926	45.2	1,838	43.0
Wholesale Supply Houses	343	8.2	275	6.5	290	6.8	295	6.9
Bell Operating Co.	466	11.1	562	13.2	532	12.5	517	12.1
Independent Telco	206	4.9	90	2.1	55	1.3	65	1.5
Total	4,199	100.0	4,259	100.0	4,260	100.0	4,275	100.0

Source: NATA Market Research Department

Table 33

1989 Key System Market Penetration, by End-use Industry

	Percent
Banking/Finance	11
Engineering/Legal/Management	16
Government	8
Health/Education	15
Insurance	5
Manufacturing	10
Residential	1
Retail	15
Transportation	5
Wholesale	10
Other	4
Total	100

Source: Gartner Group

Table 32

Installed Base of Key and Hybrid Market, 1984-1995

	1984	1985	1986	1987	1988	1989	*CAGR (Percent)
Total Stations: thousands	27,625	28,186	28,874	29,105	29,325	29,566	1.4
Total Systems: thousands	5,085	5,151	5,259	5,197	5,237	5,280	0.8
Average Stations/Systems	5.4	5.5	5.5	5.6	5.6	5.6	0.7

	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	*CAGR (Percent)
Total Stations: thousands	28,492	28,043	27,800	28,778	28,996	29,917	1.0
Total Systems: thousands	5,000	4,920	4,877	4,961	5,000	5,071	0.3
Average Stations/Systems	5.7	5.7	5.7	5.8	5.8	5.9	0.7

(e) Estimated
* Compound Annual Growth Rate
(p) Projected

Source: NATA Market Research Department

Table 34

Key/Hybrid Manufacturer Market Shares, by Stations Shipped, 1988, 1989(r) and 1990(e)

	1988	1989	1990
	- - - - Percent	- - - -	
AT&T	26	26	28
TIE	18	16	15
Executone	10	10	11
Northern Telecom	1	7	10
Toshiba	9	8	8
Comdial	4	6	7
Inter-Tel	5	4	4
Alcatel/ITT/Cortelco	3	4	4
NEC	3	3	3
Iwatsu	3	3	2
Panasonic	3	3	2
Others	15	10	6
Total	100	100	100

(e) Estimated
(p) Projected

Source: NATA Market Research Department

Data Communications Equipment Market

Introduction

Data communications represents the overlap between data processing and traditional communications. As the technologies of the two industries have merged, so have the applications of the technologies. With the proliferation of computers has come the concept of distributed processing. Traditionally, most computers have been of the mainframe type and users typically have had access through "dumb" terminals capable only of displaying stored information. If the terminal was not at the same location as the mainframe, a modem was necessary for communications through the telecommunications network. As computer technology has evolved with more and more memory and processing available from smaller and smaller machines, mini computers and personal computers have begun to be developed. Today, data processing is often performed away from the mainframe, leaving the mainframe free to manage extremely large databases or perform ver- complex data processing tasks.

The tremendous growth in distributed processing and computers in general has caused the data communications market to grow rapidly. In addition, a large and growing market has developed for value added networks (VANs) such those used for as credit card validation, electronic funds transfer, electronic mail, etc., that is having a significant impact on the demand for data communications equipment. Of the numerous types of data communications equipment, those addressed here include modems, multiplexers, packet switching equipment, front-end processors, concentrators, and network controllers.

Modems, developed in the early 1960s, are among the oldest data communications products. The word "modem" is a contraction for modulator/demodulator. Modems interface computers with the telephone network by converting the transmitting computer's binary or digital code into a form that can be transmitted by telephone line using analog or audio-frequency shift keying tones. At the receiving end a second modem converts the signal back to its binary format. Modems can be made to operate at different speeds, depending upon the system architecture at both ends.

Multiplexers are devices that interweave several communications signals or channels to increase the capacity of a telecommunications network. This interweaving can be done either by frequency division, in which each channel is allocated a different frequency within the wideband carrier, or by time division, in which each channel consists of a series of pulses, interleaved on a time-sharing basis. One of the more prevalent types of multiplexer is the T1 multiplexer. This device multiplexes channels through a T1 circuit. A T1 circuit is a high capacity, time-multiplexed transmission pipeline. The T1 circuit is increasingly being used to interconnect telephone company central offices and to provide private voice and data networks, video transmission, long distance communications, etc., in basically any situation where high capacity and speed are necessary. Another advantage of T1 networks is their compatibility with digital PBXs, packet switching nodes, and asynchronous terminals.

Packet switches are also devices that increase the capacity of telecommunications networks by enabling a single channel to be used for multiple concurrent transmissions. This can be accomplished because the data to be transmitted to different destinations are formed into packets to which electronic addresses are assigned. The data are then sent as a continuous stream and switched to appropriate destinations by means of a packet switch. Packet switches are efficient for "bursty" high-speed data communications because lines are tied up only while data are transmitted. By contrast, circuit switching maintains an open connection even when no information is being transmitted. Data transmission over a packet-switched network can be at least 50 percent cheaper than over normal circuit-switched telephone lines. Packet switching networks are becoming very popular due to their use in VANs.

Front-end processors are auxiliary computers attached to a network to perform control operations, freeing up the host computer for data processing. Increasingly, software is being developed for the front-end processor that allows support of multiple host-computers, network diagnostics, and protocol conversion.

Concentrators are devices that perform a function similar to both multiplexers and packet switches in the sense that both types of equipment are designed to maximize the capacity of a given telecommunications transmission circuit. Concentrators can be of several different types.

One popular type is a compression concentrator, which compresses the data by reducing the number of bits required to represent a character or a whole block of data, so the user gains more transmission bandwidth.

LANs are dedicated data communications facilities providing high-speed switched connections, generally over a distance of less than a few miles, typically within a building or a campus environment. Essentially, a LAN is a specialized private data network, designed to provide high-speed, high-bandwidth data transmission among a number of different types of data terminal equipment. LANs consist of a transmission medium, a network controller and a LAN gateway for interaction with the public network.

Market Review

The data communications market has increased rapidly over the last several years from $3.2 billion in 1984 to $7.8 billion in 1989 and is expected to reach $10.9 billion by 1995 (see Table 35). Part of the increase in sales of data communications equipment can be attributed to increasing sales by interconnect companies. In an effort to increase profitability and customer satisfaction, interconnects have begun to broaden the scope of their product and service offerings.

The market for modems grew at a rather healthy rate from 1984 to 1987, but is expected to level off in the future as the implementation of all-digital networks obviates the need for modems (see Fig. 43). It will be many years, however, before the entire telecommunications network is digital. In meantime, the proliferation of personal computers, especially in the home, will keep the demand for modems at a moderate level.

Products that maximize the capacity of a network, such as multiplexers, packet switching equipment, and concentrators, have recently become important as users begin to demand high speed data lines for the proliferation of new data networks. Systems managers need to ensure that the network has the capacity to allow continued growth of these new telecommunications seervices.

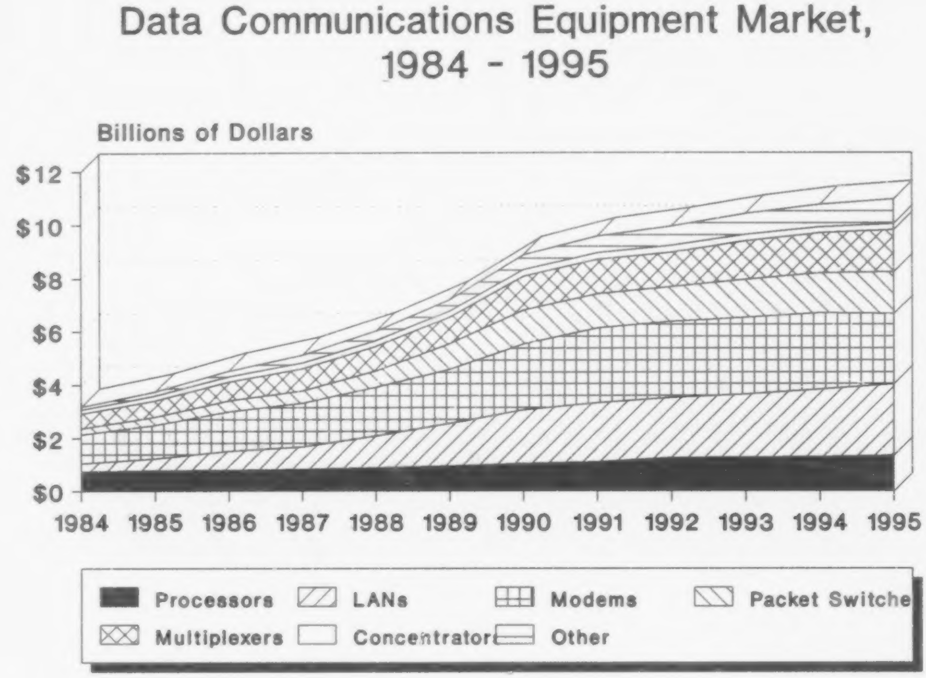
The market for multiplexers grew steadily from $550 million in 1984 to $1.0 miilion in 1989. Growth is expected to accelerate in the next several years to reach $1.6 billion by 1995.

This dramatic rise will result from increased use of T1 networks for data and voice transmission and ultimately for ISDN. Largely as a result of VANs, the market for packet switching equipment has increased from $225 million in 1984 to $950 million in 1989 and is expected to exceed $1.6 billion in 1995. The market for concentrators has increased from $165 million in 1984 to $230 million in 1989 and is expected to increase to $260 million by 1992. With the implementation of ISDN, a decrease in demand is anticipated; by 1995 the market is expected to have shrunk to $235 million.

As communication to and between mainframe computers becomes commonplace, front-end processors will often be required to sort out the protocols and other aspects of communications. The market for these devices increased only moderately from $751 million in 1984 to $965 million in 1989, but is expected to increase more rapidly in the future and to amount to over $1.4 billion by 1995. Likewise, as the demand for communications between personal computers grows stronger, LANs will become more popular, particularly for intra-office communications. The market for LANs increased from $300 million in 1984 to $1.6 billion in 1989 and is expected to grow to $2.7 billion by 1995.

Channels of distribution for data communication products vary by type of product. Types of channels include computer dealers (independent and chain), systems integrators, manufacturer direct sales forces, wholesale supply houses, interconnects, value added resellers, value added distributors, and mail order houses. Because data communication represents the middle ground between data processing and voice communications, it is sold by distributors of both types of products. In general, though, products such as front end processors used expressly with computers are sold more often through computer-oriented outlets, while T1 multiplexers used for voice communications might very well be sold by interconnects.

Figure 43



Source: NATA Market Research Dept.

Table 35

Data Communications Equipment Market, 1984-1995

Equipment	1984	1985	1986	1987	1988	1989	CAGR*
	- - - - - - millions of dollars					- - - - - - -	(Percent)
Front-end processor	751	790	815	845	896	965	5.1
Local area networks	300	450	700	840	1,200	1,590	39.6
Modems	1,100	1,266	1,500	1,650	1,840	2,035	13.1
Packet switching equipment	225	305	410	452	601	950	33.4
Multiplexers	550	613	700	840	910	1,005	13.0
T-1 multiplexers	80	150	174	275	340	615	50.4
Concentrators	165	180	197	209	219	230	6.9
Other	100	150	210	290	360	430	33.9
Total	3,191	3,754	4,532	5,126	6,026	7,820	19.6

Equipment	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	CAGR*
	- - - - - - - - - - millions of dollars					- - - - - - - -	(Percent)
Front-end processor	1,055	1,125	1,275	1,282	1,295	1,350	5.0
Local area networks	2,020	2,210	2,251	2,375	2,550	2,685	5.9
Modems	2,450	2,785	2,850	2,875	2,850	2,625	1.4
Packet switching equip.	1,275	1,295	1,300	1,430	1,502	1,577	4.3
Multiplexers	1,210	1,260	1,375	1,425	1,460	1,550	5.1
T-1 multiplexers	700	725	790	950	1,100	1,250	12.3
Concentrators	250	250	260	250	225	235	-1.2
Other	550	620	710	785	840	910	10.6
Total	8,810	9,545	10,021	10,422	10,722	10,932	4.4

(e) Estimated
* Compound Annual Growth Rate
(p) Projected

Facsimile Terminal Market

Introduction

A facsimile terminal is a device that scans a document, encodes the information contained on the document, and transmits the document over a telecommunications circuit to be reproduced at the receiving end. The scanner sweeps across a page, segmenting it into multiple lines in a fashion analogous to the way an electron beam scans the faceplate of a television picture tube. The scanner produces an output that is either a continuous analog signal that varies between black and white, or a digital output that converts the image to a binary code. Control equipment directs the scanning rate and, in the case of digital facsimile, processes the signal to compress solid expanses of black or white. At the receiving end, the incoming signal is demodulated and drives a print mechanism that reproduces the received image on paper.

Facsimile transmission was invented in 1843. Despite this early introduction, facsimile transmission was not used extensively until the 1920s, when it began to be used to transmit wire photographs and weather maps. It has only recently become a business tool. Early models were bulky and produced rather poor quality copy. Recent innovations have made the facsimile terminal practical for a mass market.

Since facsimile transmission involves the coding of information, the coding format must be standardized to achieve universal intercommunication. The most prevalent standards in use have been established by the CCITT, a committee within the International Telecommunications Union, part of the United Nations. The CCITT has established four standards for facsimile transmission (Group 1, Group 2, Group 3, and Group 4). Group 1 requires six minutes for transmission of a printed page; Group 2 requires two to three minutes; Group 3 requires one minute or less; and Group 4 requires only a few seconds.

Market Review

The market for facsimile terminals has taken a number of years to reach the critical mass necessary for the market to take off. In terms of the value of the market, there was even a slight slump in 1985, when the market amounted to $164 million, down from $175 million in 1984 (see Table 36). Since 1985, however, the market has experienced tremendous growth. In 1989, the market amounted to 1.9 million terminals valued at $2.9 billion. The market is expected to soar even more rapidly in the immediate future and reach 6.6 million terminals valued at $6.5 billion in 1995. The estimated number of fax transmissions has skyrocketed from 10 billion pages in 1987 to about 45 billion pages in 1990. The growth of the relative market shares of the different CCITT group types is shown in Figure 44.

Faxes are sold through several distribution channels. By far the most prevalent channel is through office-supply dealers, which accounted for 45 percent of the market in 1989 (see Fig. 45). Other important channels include retail with 30 percent, and manufacturer direct with 15 percent. Sales through interconnects account for the remaining 10 percent.

There are dozens of suppliers of fax terminals, each trying to capture market share. The most popularly sold brand of fax terminal in 1989 was Sharp, which captured 22 percent of the market (see Fig. 46). Other important suppliers included Murata with 18 percent of the market, Canon with 11 percent, and Ricoh and Panasonic, each with 8 percent.

The growth in the installed base of fax terminals mirrors the growth in annual sales. The installed base increased steadily from 125 thousand units in 1984 to 2.8 million in 1989 and is expected to reach 15.2 million by 1995.

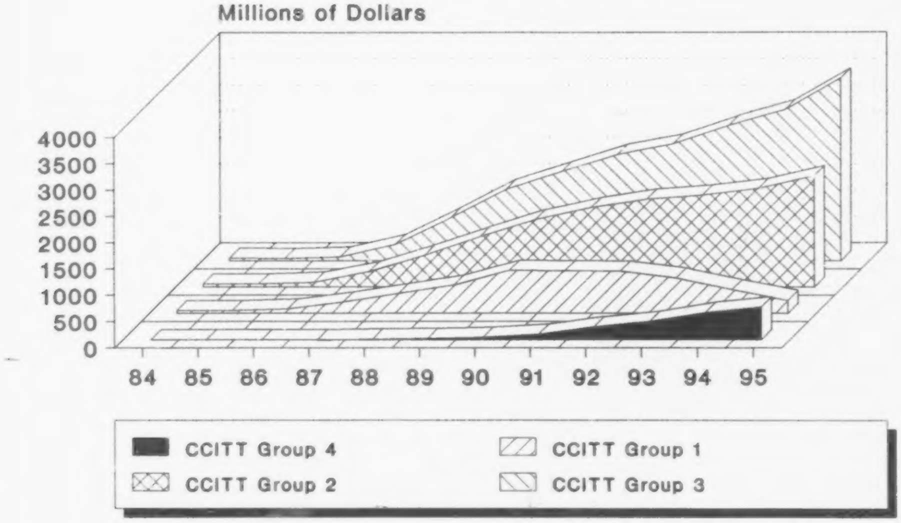
The industry sector that most commonly uses fax terminals is manufacturing. About 97 percent of all manufacturing facilities use fax transmission (see Fig. 47). The business services sector is next, with 96 percent of all banks using faxes. The lowest fax penetration is found in the government, with 83 percent of government facilities using facsimile terminals.

Along with traditional fax terminals, other innovative products such as fax boards, fax servers, and fax switches are gaining wide use. The use of fax boards in PCs is accelerating to improve the graphics quality and speed of faxed messages. Sales of PC/fax boards are expected to increase from 92,000 units in 1989 to 179,000 in 1990. Fax servers are also becoming attractive alternatives that likewise improve graphics quality and speed while allowing LAN users to share a fax gateway. In addition, small businesses trying to keep the number of telephone lines to a minimum are becoming interested in fax switches, which allow users to have one line for both voice and fax traffic.

Beyond equipment sales, interexchange carriers have gotten into the game by offering high speed fax transmission services. These services offer users advanced features such as polling and broadcasting. The market for these fax services is estimated to be about $200 million annually.

Figure 44

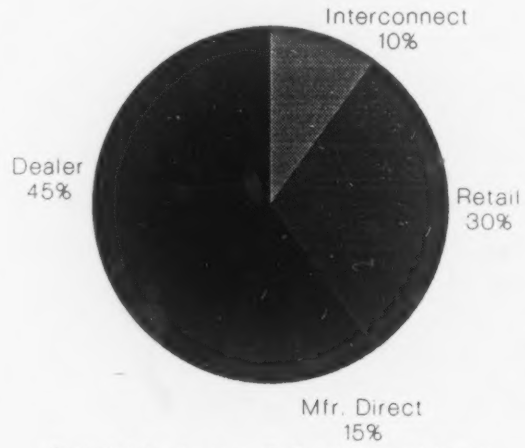
Facsimile Terminal Market, by Type, 1984-1995



Source: NATA Market Research Department

Figure 45

1989 Facsimile Terminal Distribution Channels

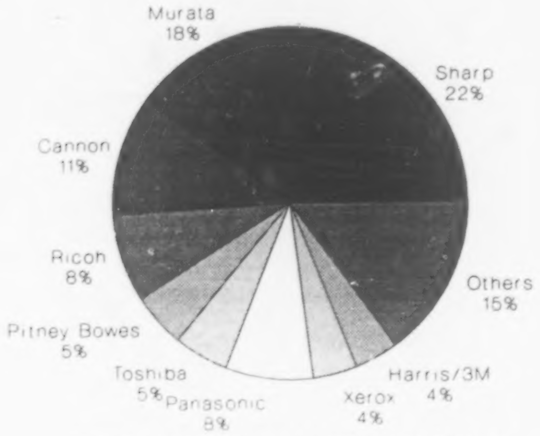


Total Market = 2.9 Million Units

Source: Estimated By the NATA Market Research Department Based on Various Industry Sources

Figure 46

1989 Facsimile Terminal Manufacturer Market Shares of Units Shipped

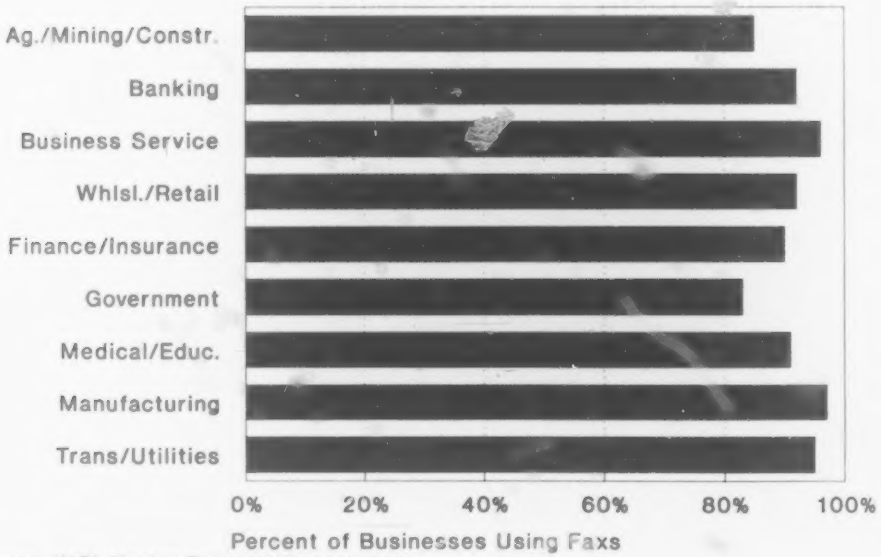


Total Market = 11 Million Units

Source: NATA Market Research Department

Figure 47

1989 Facsimile Terminal Penetration, By Industry



Source: NATA Market Research Department

Table 36

Facsimile Terminal Market, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR*
							(Percent)
Annual Sales:							
Quantity: thousands	35	36	75	350	1,050	1,925	122.9
Total Value: $ millions	175	164	260	821	1,825	2,887	75.1
CCITT Group 1: $ millions	58	54	86	215	376	538	56.1
CCITT Group 2: $ millions	63	60	96	295	610	959	72.4
CCITT Group 3: $ millions	54	50	78	311	823	1,365	90.8
CCITT Group 4: $ millions	0	0	0	0	15	25	66.7
Installed Base: 1000 Units	125	160	225	570	1,100	2,855	187.0

	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	CAGR*
							(Percent)
Annual Sales:							
Quantity: thousands	2,750	3,375	4,065	4,575	5,763	6,573	19.0
Total Value: $ millions	3,850	4,457	4,958	5,361	5,723	6,476	11.0
CCITT Group 1: $ millions	817	810	805	675	450	250	-21.0
CCITT Group 2: $ millions	1,283	1,515	1,675	1,755	1,875	3,120	10.6
CCITT Group 3: $ millions	1,700	2,027	2,228	2,581	2,876	3,481	15.4
CCITT Group 4: $ millions	50	105	250	350	522	625	66.0
Installed Base: 1000 Units	4,422	6,571	9,500	11,374	13,210	15,159	28.0

(r) Revised
(e) Estimated
* Compound Annual Growth Rate
(p) Projected

Source: NATA Market Research Department

Consumer Telecommunications Market

Introduction

The consumer telecommunications market dates back over a hundred years with the invention of the telephone. Since then, the telephone and the telephone system have evolved to provide users with better service and more features. The telephone itself has evolved from an electromechanical to an electronic device. The switch to electronics began in the 1960s and 1970s as the transistor gave way to its successor, the integrated circuit. With the conversion to electronics, advanced features became available. In the late 1970s, the cordless telephone and the consumer telephone answering machine were developed. On the horizon for consumer telecommunications is the ISDN, which will provide consumers with the ability to achieve voice, data, and video communication through a video telephone terminal. Common services most likely to be available will be catalog browsing and purchasing, electronic mail, electronic banking, etc. This study, however, addresses only the U.S. market for corded telephones, cordless telephones, and telephone answering machines.

Over 90 percent of households in the United States have telephone service, representing a large market for telephone instruments. Since the late 1960s, consumers have been legally able to buy and install telephone equipment. However, due to general inertia the market did not take off until the 1980s. During 1982 to 1984, cheap, one-piece telephones became very popular, and millions of them were sold. Their popularity died out, however, due to lack of good sound quality and reliability. Currently, the market for consumer phones is driven by features such as hold, speed dialing, mute, liquid crystal displays, etc.

Market Review

The market for all types of corded telephones increased from $1.2 billion in 1984 to $1.9 billion in 1989 (see Table 37 and Fig. 48). It is expected to increase to $2.9 billion by 1995. The market for full-feature phones has been the fastest growing segment, increasing from $110 million in 1984 to $750 million in 1989, and is expected to exceed $1.9 billion by 1995. The changes in relative market shares of the different types of phones are presented in Figure 49.

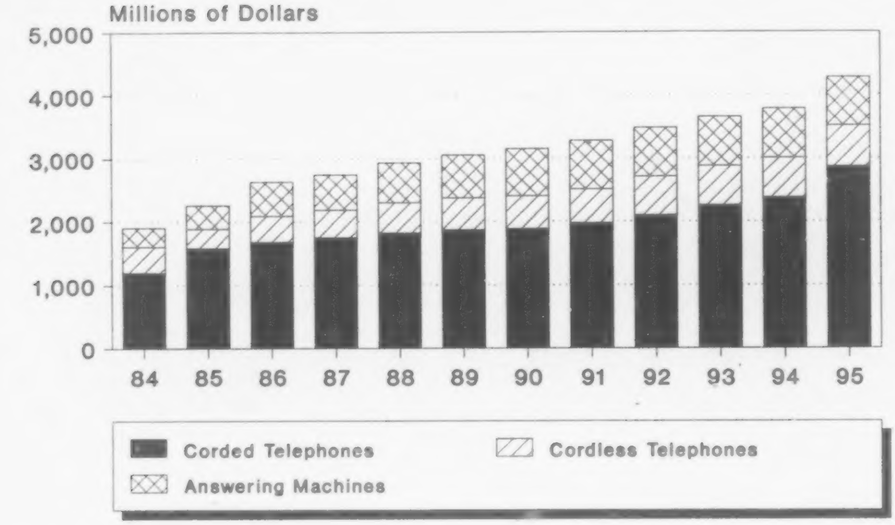
The market for cordless telephones also went through a period of extreme popularity in the early 1980s, but this popularity waned as problems with unauthorized use (or monitoring), sound quality, and reliability became apparent. New models, using different frequencies and having increased protection from unauthorized use, became available in the mid-1980s. The market for cordless telephones decreased from $410 million in 1984 to $305 million in 1985 before increasing to $498 million in 1987.

The market for telephone answering machines has increased from $298 million in 1984 to $680 million in 1989. The demand for telephone answering machines has been held in check by reluctance on the part of some consumers to "talk to a machine." This reluctance, however, is being overcome as our society becomes dominated by families where both spouses work and where there are large segments of time during the day when no one is home. In addition, more businesses are installing voice messaging systems (discussed in the next section), which is making the general public more comfortable with leaving a message. Also, the BOCs were recently granted the ability to offer voice messaging services. Undoubtedly, before long there will be BOC advertising campaigns underway across the country which will familiarize people with the benefits of talking to a machine. By 1995 the market is expected to reach $765 million.

Consumer telecommunications products are typically sold through the retail channel. According to figures compiled from *Telecommunications Equipment Retailer*, the national average of sales per retail store selling consumer telecommunications equipment amounted to $485,185 in 1988 (the latest year for which data are available), with the highest sales per store being registered in the Midwest and the lowest sales per store registered in the Southeast (see Table 38).

Figure 48

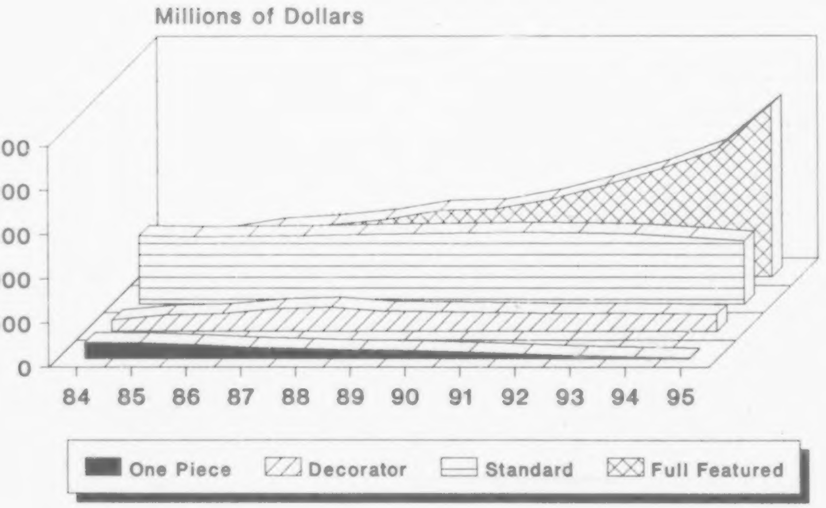
Consumer Telecommunications Equipment Market, 1984-95



Source: Various Industry Sources

Figure 49

Corded Telephone Instrument Market, by Type, 1984-95



Source: Various Industry Sources
(see table 47)

Table 37

Consumer Telecommunications Marketplace, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR* (Percent)
Corded Telephone Instruments:							
Standard:							
Value: $ millions	775	765	770	775	788	795	5.1
Quantity: million units	26	27	29	31	34	34	5.5
One Piece:							
Value: $ millions	185	180	162	129	115	100	11.6
Quantity: million uits	12	12	11	10	10	9	12.1
Decorator:							
Value: $ millions	130	190	207	257	275	230	12.1
Quantity: million units	2	3	3	4	5	5	2.0
Full-featured:							
Value: $ millions	110	450	551	589	647	750	47.0
Quantity: million units	1	2	3	4	5	6	43.1
Total:							
Value: $ millions	1,200	1,585	1,685	1,750	1,825	1,875	9.3
Quantity: million units	41	44	46	49	53	54	5.7
Cordless Telephones:							
Value: $ millions	410	305	410	438	474	498	4.0
Quantity: million units	4	3	4	4	5	5	4.6
Telephone Answering Machines:							
Value: $ millions	298	371	535	557	634	680	17.9
Quantity: million units	4	5	7	7	9	9	17.6

	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(e)	CAGR* (Percent)
Corded Telephone Instruments:							
Standard:							
Value: $ millions	805	810	805	790	755	715	-2.3
Quantity: million units	35	35	36	36	35	34	-0.6
One Piece:							
Value: $ millions	95	75	55	35	20	10	-36.3
Quantity: million uits	9	8	6	4	3	2	-26.0
Decorator:							
Value: $ millions	225	215	205	205	200	195	-3.0
Quantity: million units	5	5	4	4	4	4	-4.4
Full-featured:							
Value: $ millions	765	875	1,035	1,220	1,440	1,943	20.5
Quantity: million units	6	7	9	10	12	15	20.1
Total:							
Value: $ millions	1,890	1,975	2,100	2,250	2,375	2,863	8.7
Quantity: million units	55	55	55	54	54	55	**
Cordless Telephones:							
Value: $ millions	515	535	612	625	630	650	4.8
Quantity: million units	6	6	7	7	8	9	8.4
Telephone Answering Machines:							
Value: $ millions	750	770	790	780	775	765	0.4
Quantity: million units	10	11	11	12	12	13	5.4

(e) Estimated
(p) Projected
* Compound Annual Growth Rate
** Less than .05 percent

Source: NATA Market Research Department

Table 38

1988 Telecommunications Retail Market, by Region

	West	South West	East	South East	Mid West	National
1988 Sales Per Store	$430,270	$237,308	$310,429	$208,571	$1,065,385	$485,185
1988/1987 Growth	42%	10%	45%	39%	15%	27%
Avg. No. of Outlets	2.4	1.0	1.1	1.0	3.4	1.9
Avg. No. of Employees per Store	4.6	5.9	4.4	3.6	5.1	4.8
Avg. Sales/Employee	$101,401	$ 40,065	$ 67,906	$ 56,153	$ 74,462	$ 75,741

Source: Telecommunications Equipment Retailer, December 1988

Call/Voice Processing Equipment Market

Introduction

The equipment discussed in this section answers, records, routes, distributes, makes, or otherwise manipulates telephone calls. The specific products addressed are voice messaging systems, voice response units, and automatic call distributors. Probably the most popular of the three is the voice messaging system, a product that has been available in its present form since the early 1980s. Voice messaging, also called voice mail, is sometimes available as an optional feature on a PBX, but frequently it is a separate piece of equipment used as an adjunct to a business telecommunications system. A caller dials the called party's mailbox number and leaves a message. The called party can retrieve messages by dialing the mailbox from any touch-tone telephone and entering a security code. By entering instructions using the key pad, the user can repeat, erase, forward, broadcast, or file the message.

Compared to an ordinary consumer answering machine, voice mail gives the called party more flexibility. Voice messaging systems have become popular, especially with businesses, because they reduce the need for an operator, receptionist, or secretary to answer calls and take messages. Some studies estimate that 50 percent of all telephone calls are made simply to convey information and do not require a two-way conversation. In many cases, the age-old game of "telephone tag" can be cut considerably, if not eliminated.

An automatic call distributor (ACD) is a device that concentrates incoming calls to a group of attendant service positions. An ACD is either a stand-alone system or is included as a feature in a PBX. Typical applications are the service departments of large, high-telephone-traffic organizations such as airlines, utilities, catalog houses, and department stores. Incoming calls can be routed to an attendant position on the basis of incoming line type or other variables. When attendant positions are idle, the call is routed immediately. When the attendant positions are busy, calls are answered and placed in a queue, and the caller is notified by a recorded announcement that the call will be held until the next available operator is free.

Voice response systems incorporate some voice messaging-like features with other equipment, such as automatic attendants and data base management equipment, to provide automated call processing functions. Typically, these integrated voice response systems consist of hardware and software customized for an individual customer or type of customer.

Voice response systems can be interactive or noninteractive. An interactive system answers a call, gives the caller options from which to select, accepts responses entered by the caller using the telephone keypad, and allows the caller to access a data base and make some change to that data base. For example, a bank might have an interactive voice response system that would allow a customer to access his or her account, transfer funds, pay a credit card bill, etc. A noninteractive system simply gives the caller options, accepts the caller's choice of options, processes the caller's options by interacting with some external data base, and finally provides verbal information regarding the transaction. As an example, a centralized, city-wide events ticketing bureau might maintain a noninteractive voice response system whereby a caller would call up and, through a menu, ask for the time, date, and place of a particular event. The system would search through a data base, find the information, and, perhaps through synthesized speech, respond to the caller's inquiry.

Market Review

The market for call/voice processing equipment has increased from $112 million in 1984 to $1.6 billion in 1989 (see Table 39). Most of this equipment is distributed and installed by the interconnect industry. These products have been among the key add-on peripherals that interconnects have begun to sell to increase profit margins and customer satisfaction.

The principal product area is the voice messaging equipment market, which increased from $5 million in 1984 to $665 million in 1989 (see Figure 50). The market for this equipment is expected to grow to about $1.2 billion by 1995. In addition, the FCC recently decided to allow telephone companies to offer voice messaging services. While many analysts believe this will stimulate the market, others are concerned that the initiative may lead to a shakeout of voice processing manufacturers due to the extensive resources available to the telephone companies and the possibility of anti-competitive telco activities.

The equipment market is spread widely over a number of suppliers. In terms of revenue, the largest market share in 1988 went to Octel, with 20 percent, followed by AT&T with 15 percent, and VMX with 10 percent (Fig. 51). In terms of systems, Cobotyx had the largest market share in 1989 with 23 percent (Fig. 52).

The market for voice response systems increased from $10 million in 1984 to $350 million in 1989. The market for these products will continue to increase rapidly as consumer acceptance and new applications develop. By 1995, the market will surpass the value of the voice messaging equipment market and amount to $1.4 billion.

As with the voice messaging marketplace, the voice response equipment market has a number of suppliers, none of which dominate the market. The largest market share in 1988 went to AT&T with 13 percent, followed by Intervoice with 8 percent (Fig. 53).

Other types of equipment are more specialized products. Even so, the market for ACDs has increased from $95 million in 1984 to $425 million in 1987 and is expected to amount to $915 million in 1995. The market for ACDs is dominated by several suppliers. In 1989, Rockwell had 43 percent of the market, Teknekron had 29 percent, and Telecom Technologies had 20 percent (see Fig. 54).

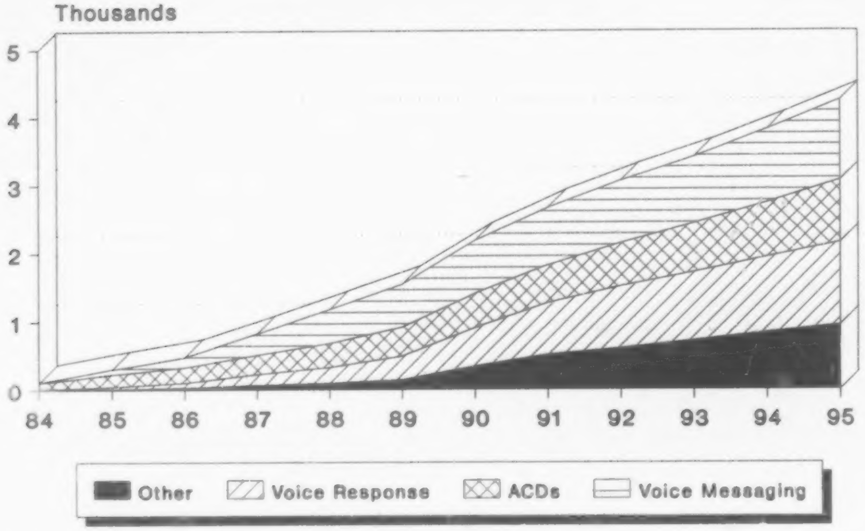
Other types of products in this category include stand-alone automatic attendants (most automatic attendants are incorporated features in a PBX or voice/call processing unit), speech recognition devices, voice synthesizers, auto dialers, and similar equipment. The market for these products is expected to expand substantially through the next several years. Particularly noteworthy are speech recognition and voice synthesis. These technologies will develop rapidly and add a new dimension to voice/call processing. Once perfected and available in commercial quantities at moderate price levels, they will represent a significant impetus for the growth of all voice/call processing markets as they greatly expand the functionality and flexibility of the different systems.

One aspect of the marketplace which is impacting voice processing equipment sales is the expansion of the voice processing services businesses. Voice processing services, principally voice messaging services, are offered by independent service bureaus that allow customers to subscribe to voice mail boxes for a certain fee per month. In addition to these independent service bureaus, the local telephone companies and long distance carriers are all offering, or planning to offer, voice messaging services to residential and business customers.

Some sources estimate that the number of subscribers of voice messaging services increased from 435,700 in 1988 to 1.1 million in 1990. From 1990, subscribership is projected to grow at a compound annual growth rate of 68 percent to 15 million by 1995. Revenue to the service bureaus is expected to experience similar growth. In 1990, revenues amounted to some $250 million, up 79 percent over the 1988 figure of $140 million. By 1995, revenue is expected to grow to $1.7 billion.

The impact on equipment sales will be mixed. Certainly there will be some displacement of equipment sales by service bureau subscribership, but in general, service bureaus tap the residential and small business market (although there are notable exceptions). This is not the market that would typically buy voice processing CPE. Furthermore, acclimating residential and small business users to voice processing technology should help stimulate the entire marketplace.

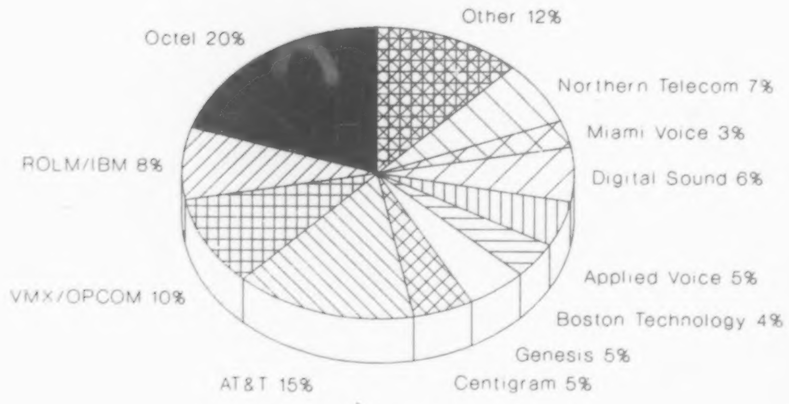
Figure 50



Call/Voice Processing Equipment Market, by Type, 1984-95

Source: NATA Market Research Department

Figure 51



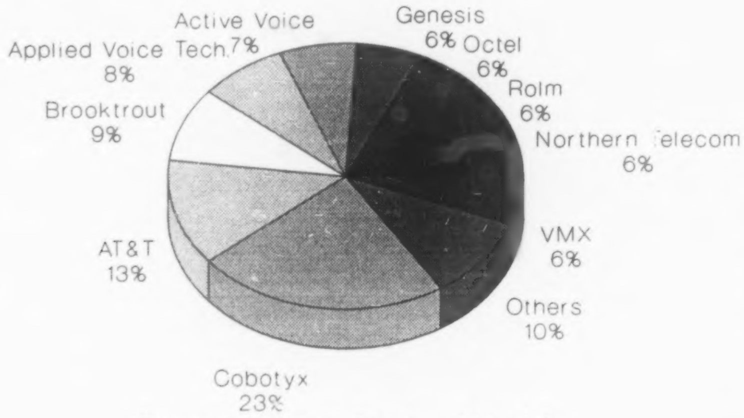
1989 Voice Messaging Equipment Market, by Vendor

1988 Total Market = $665 Million

Source: NATA Market Research Department

Figure 52

1989 Voice Messeging Equipment Market, by Systems, by Vendor

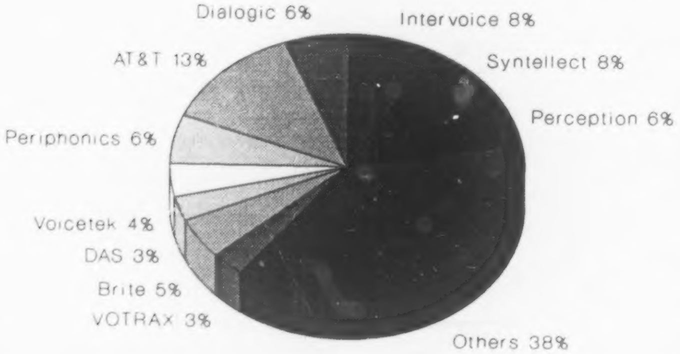


Total Systems Sold - 20,400

Source: Dataquest

Figure 53

1989 Voice Response Equipment Market, by Vendor

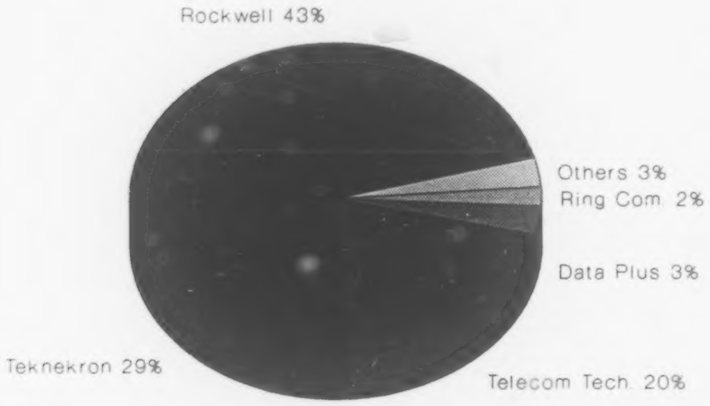


1989 Total Market = $ 350 Million

Source: Estimated by the NATA Market Research Dept. based on figures of Vanguard Communications Corporation.

Figure 54

1989 Stand-Alone ACD Market, by Vendor



Total 1989 Market = $425 Million

Source: Estimated by the Market Research Department based on various industry estimates.

Table 39

Voice/Call Processing Marketplace, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR*
	Millions of Dollars						Percent
Voice Messaging Equipment	5	75	150	315	500	665	166.0
Voice Response Equipment	10	35	75	160	235	350	103.6
Automatic Call Distributors	95	183	228	285	350	425	35.0
Other **	2	15	30	70	100	150	137.1
Total	112	308	483	830	1,185	1,590	170.1
	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	CAGR*
							Percent
Voice Messaging Equipment	775	895	975	1,055	1,125	1,210	9.3
Voice Response Equipment	563	755	905	1,195	1,223	1,395	20.1
Automatic Call Distributors	500	550	630	715	805	915	12.8
Other **	350	520	610	725	845	950	122.1
Total	2,188	2,720	3,120	3,690	4,008	4,470	14.2

(r) Revised
(e) Estimated
* Compound Annual Growth Rate
** Includes stand-alone auto attendants speech recognition, voice synthesis, and similar equipment

Source: NATA Market Research Department

Public Payphone Market

Introduction

The pay telephone was invented in 1889 by William Gray. Working part time for Gray, George Long, a 16-year old apprentice at Pratt & Whitney Co., built the first coin operated telephone, which was installed in the Hartford Bank in Hartford, Connecticut. The pay telephone became very popular and attracted the attention of AT&T. In 1910, the Gray Telephone Pay Station Co. and AT&T joined forces to produce pay telephones. That arrangement lasted until 1934, when Gray sued AT&T for patent infringement and lost. AT&T soon became the only major commercial producer of pay telephones. This lasted until recently, when other domestic producers and foreign producers began vying for a piece of the growing payphone market.

The public pay telephone has been owned and operated by the local telephone company for virtually its entire one hundred year history. Competing companies, however, now have the opportunity to own and operate public payphones. Along with ownership comes all of the revenue potential of the device. Still, the marketplace for payphones is complex, and potential payphone operators must understand all aspects of the legal and marketing environment before attempting to explore the emerging opportunities.

Much of the complexity of the competitive payphone environment comes from a hodgepodge of regulations varying widely by state. Moreover, many regulations on competitive payphone operators exacerbate a condition with which all of them must contend --an uneven playing field when competing against telco-owned payphone operations.

The competitive payphone business began in June 1984, when the FCC opened the pay telephone equipment market to competition. The FCC ruled that parties other than telephone companies may own pay telephones connected to the interstate telephone network, provided the equipment is registered under Part 68 of the commission's rules and regulations.

While the 1984 FCC ruling opened the way for entrepreneurs to connect telephones to the interstate telephone network, the terms and conditions for the use of payphones for local and intrastate calling were left to the states. Because the states have exercised that mandate vigorously in some cases, a wide diversity exists in how states treat competitive payphones. Furthermore, despite the 1984 FCC ruling, competitive payphones are still illegal in Alabama, Arkansas, Connecticut, Hawaii, and Oklahoma. In those states, payphone competition has been precluded through the states' regulatory control over intrastate communications.

It becomes apparent from studying both the pluses and the minuses of the private payphone industry that these companies provide a valuable service to consumers. But to local exchange companies, revenue from payphone operations is a minimal portion of their overall income. The telcos traditionally have had little incentive to offer innovative payphone services or to explore all worthwhile locations for payphones. Competitive payphone operators, on the other hand, have brought about a revolution in public communication services, including credit card calling, public fax, store and forward voice messaging, voice synthesis, speed dialing, and data ports for lap-top computers.

In addition, because it usually is their only business, payphone operators are extremely concerned about downtime, vandalism, and customer satisfaction. Many are installing sophisticated networks that monitor when a payphone is in use or when the coinbox needs to be emptied and that perform self diagnostics to ensure proper maintenance and servicing.

A major problem for the industry is that most federal and state regulators do not fully understand the beneficial role that competitive payphone operators play. The regulatory pendulum is not necessarily swinging in favor of the independent operators. Many of them may be forced out of business as one regulatory policy after another is implemented against them.

However, there are some patches of blue in the cloudy regulatory scene. One of the more progressive states in terms of payphone competition is California. In June 1990, the California Public Utilities Commission approved a compromise among the California Payphone Association, Pacific Bell, and GTE of California. The agreement calls for the local telephone company to reduce the tariffs to competitive payphone operators by $2, reduce their charges for directory assistance, pay the competitive payphone operator 10 cents for each non-sent-paid intraLATA call routed to their networks, and provide maintenance termination unit testing on an optional basis. In addition, local carriers are to provide competitive operators with some of the services they provide for their own payphones, such as answer supervision, call scanning and rating, elimination of fraud-prone secondary dial tone, and a coin line or its equivalent.

Innovative state regulations such as California's may stimulate some activity at the federal level to put the competitive payphone industry on a more equal footing with telco-owned payphones. For example, a payphone petition filed by the Pay Telephone Council (PTC) and supported by NATA's American Public Communications Council (APCC) is pending at the FCC. The petition calls for the FCC to categorize payphones as customer premises equipment (CPE) similar to PBXs, which should be unbundled from transmission service. If adopted, the proposal would require local exchange carriers to make available to competitive operators payphone access lines with the same features currently associated only with telco payphones. Furthermore, the telco's local exchange service unit would be required to charge telco payphones and competitive payphones the same rates.

Other pending federal proposals would harm this infant industry, however. A petition filed by Bell Atlantic for billed-party preference would require payphones to deliver operator-assisted 0+ calls automatically to the long distance carrier presubscribed by the billed party, not to the carrier selected by the payphone company or location owner, eliminating contractual payments for long distance carriers for connection to those payphones. That creates no problem for telco payphones, since telcos receive substantial access fees from long distance carriers in any case. But since competitive operators receive no access fee from long distance carriers, implementation of this petition would remove a cornerstone of the competitive payphone industry.

On October 17, 1990, President Bush signed into law the Telephone Operator Consumer Services Improvement Act. The FCC must now adopt rules to protect consumers from unfair and deceptive operator services practices. Rather than set rates, the FCC will decide if tariffs filed by alternative operator services (AOS) providers are just and reasonable. All AOS providers must identify themselves twice to the party initiating the call.

As a result of strenuous advocacy by the APCC, the Act also requires the FCC to address the issues of compensation for competitive payphone providers (CPPs) for calls initiated by 10XXX, 800, and 950; whether 10XXX access or alternate access or both at CPPs should be allowed; and fraud arising from allowing 10XXX access at CPPs. Within nine months of enactment, the FCC must decide these issues and whether 10XXX access to carriers should be universally available.

Market Review

The annual market for payphones increased from 20 thousand units valued at $35 million in 1984 to an estimated 140 thousand units valued at $150 million in 1990 (see Table 40 and Fig. 55). It is expected that sales of payphones will continue to grow rapidly and amount to 225 thousand units valued at $215 million by 1995. Moreover, while the average unit price is decreasing, the average level of sophistication of the payphone is increasing. The market for retrofitting kits (kits to add additional features to otherwise "dumb" phones) amounted to some $32 million in 1989 and is expected to almost double by 1995.

In terms of the installed base, telco-owned payphones amounted to about 1.9 million units in 1988, with the BOCs alone accounting for about 1.7 million units. This is expected to remain relatively stable over the next several years. The installed base of nonLEC-owned pay telephones has been estimated as high as 200,000 units. This is expected to double by mid-1991. By then, nonLEC-owned payphones will account for some 20 percent of the installed base. Figure 49 shows the relative shares of the installed base between telco-owned and nonLEC payphones for 1984-1995.

In comparing market penetration of nonLEC-owned payphones with that of BOC-owned payphones, the most significant inroads by competitive operators have been made in the Pacific Telesis territory, where the BOCs own 190,000 payphones and competitive companies own 60,000 payphones (Fig. 56). Competitive operators have been least successful in the Ameritech territory, where the BOCs own 240,000 payphones and competitive operators own 30,000 payphones. Much of the disparity among regions is accounted for by differing regulatory environments and the awarding of several major contracts.

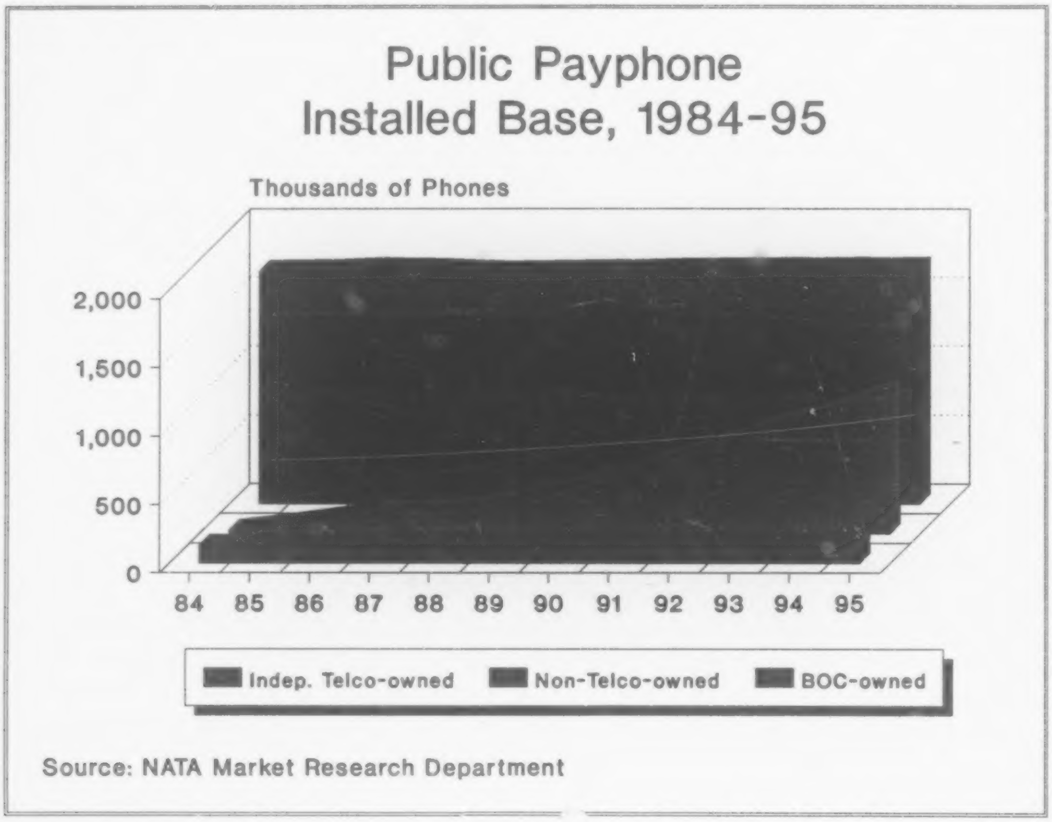
RBOC revenue generated from public payphones increased from $1.5 billion in 1984 to $1.7 billion in 1989 (see Fig. 57). Revenue is expected to increase slowly to $1.8 billion by 1995.

As a share of the total, revenue from coin calls decreased during 1986-89, and is expected to continue to decrease through 1990. Non-coin revenue is almost exclusively attributed to toll calls.

Some estimate that the total revenue from payphones, including revenue to long distance carriers, approaches $7.0 billion per year. Of that, about $2.3 billion is spent on local and coin calls and the balance on long distance calls.

In general, the operation of payphones can be very profitable. Some estimate that a single payphone can generate as much as $4,000 to $5,000 in annual revenue. A network of 100 can bring in close to half a million dollars. Gross profits from that network can exceed 35 percent, or about $175,000. This is all based on an investment of from $1,000 to $3,000 per phone. Gross annual return on investment can reach 88 percent.

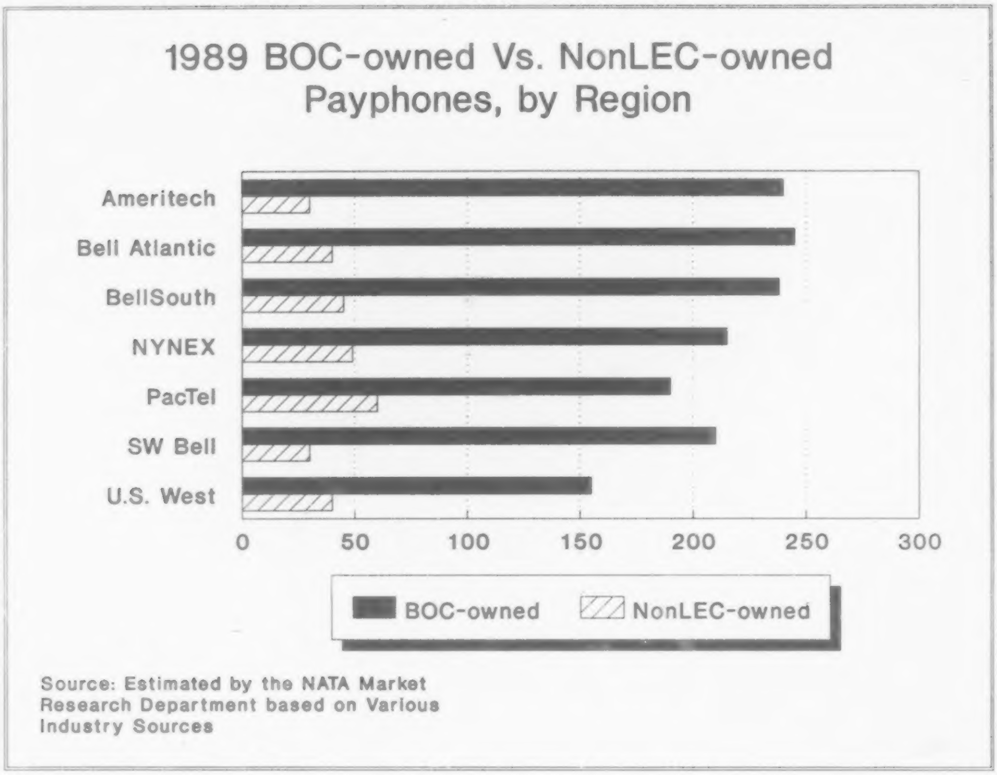
Figure 55



Public Payphone Installed Base, 1984-95

Source: NATA Market Research Department

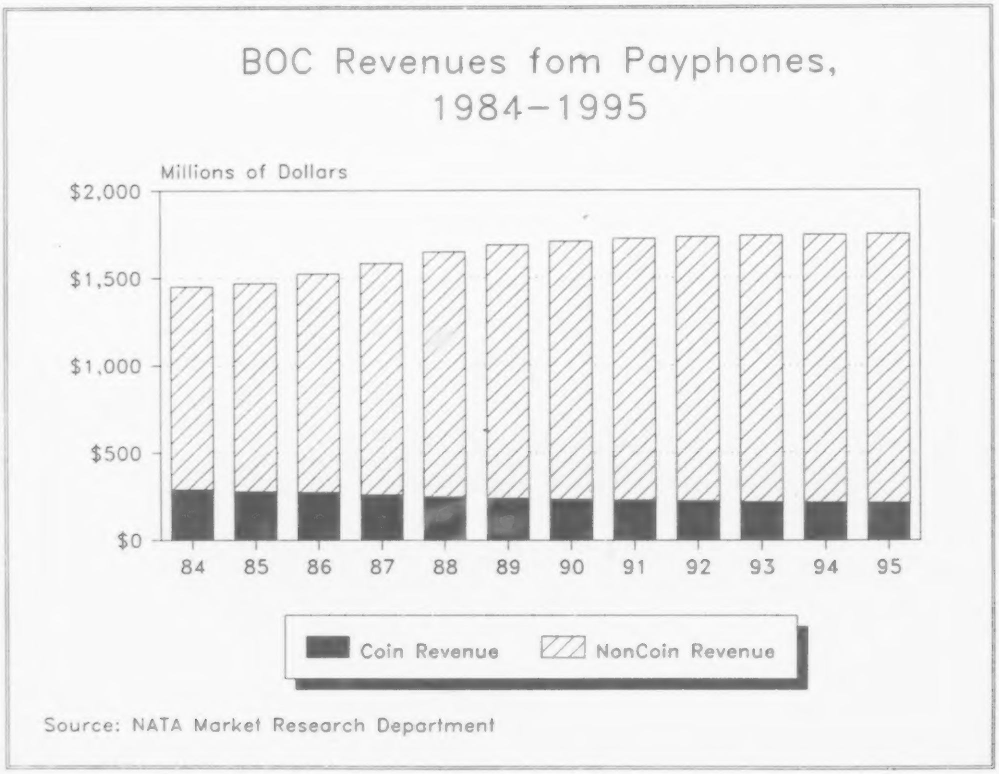
Figure 56



1989 BOC-owned Vs. NonLEC-owned Payphones, by Region

Source: Estimated by the NATA Market Research Department based on Various Industry Sources

Figure 57



BOC Revenues fom Payphones, 1984-1995

Source: NATA Market Research Department

Table 40

Public Payphone Marketplace, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR* (Percent)
Annual Sales:							
Quantity: thousands	20	23	27	45	90	140	47.6
Value: $ millions	35	37	40	60	100	150	33.8
Installed Base:							
BOC Owned: thousands	1,695	1,700	1,715	1,708	1,690	1,695	**
Independent telco: thousands	135	138	145	147	149	147	2.0
Non-telco-owned: thousands	25	75	135	175	200	295	64.0
BOC Public Payphone Revenue:							
From Coin Calls: $ millions	290	279	275	260	250	240	- 3.7
Other: $ millions	1,162	1,191	1,250	1,325	1,400	1,450	4.5
Other Payphone Related Revenue: $ millions***	1,100	1,450	1,900	2,275	2,375	2,400	17.0

	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(e)	CAGR* (Percent)
Annual Sales:							
Quantity: thousands	175	185	197	205	215	225	5.2
Value: $ millions	185	190	200	200	205	215	3.1
Installed Base:							
BOC Owned: thousands	1,700	1,710	1,713	1,715	1,718	1,720	0.2
Independent telco: thousands	145	149	147	147	149	152	0.9
Non-telco-owned: thousands	385	510	650	795	920	1,050	1.8
BOC Public Payphone Revenue:							
From Coin Calls: $ millions	235	230	225	220	217	215	- 1.8
Other: $ millions	1,475	1,495	1,510	1,520	1,527	1,535	0.8
Other Payphone Related Revenue: $ millions***	2,550	2,750	2,975	3,090	3,175	3,260	5.0

(e) Estimate
(p) Projected
* Compound Annual Growth Rate
** Less than .05 percent
*** Principally revenue to long-distance carriers and operator service providers

MOBILE COMMUNICATIONS MARKET

MOBILE COMMUNICATIONS MARKET

Introduction

In this report, mobile communications refers to networks that allow individual users to communicate with other users when at least one person is using a device connected to the network through radio transmission. In other words, satellite communications links, infrared communications, etc., are not discussed. The two most popular forms of mobile communications, and the two addressed in this report, are mobile telephony, *i.e.*, cellular radiotelephony, and radio paging.

New forms of mobile communications are being developed. One of the more promising is known as personal communications networks (PCN). PCN subscribers would have a low-powered, pocket-sized phone that would be operational only within a short distance (essentially, within sight) of a transmitter. At least initially, the subscriber would be able only to place calls, not receive them. The uses for this type phone would be similar to the uses of a payphone in that an individual placing a call would generally have to be stationary. This technology has been advanced significantly in the United Kingdom, but is only in a developmental stage in the United States.

Cellular Radiotelephony

Cellular telecommunications systems represent the newest generation of radiotelephone systems. Radiotelephones have been available for many years, but have been limited in market penetration due to the scarcity of available radio spectrum. Cellular telecommunications solves that problem by dividing a geographic area into cells and reusing frequencies in nonadjacent cells. Each cell has a low power transmitter that can transmit only within a limited area. When a person with a cellular phone travels from one cell to another, the call is "handed off" to the transmitter of the second cell. These two aspects, frequency reuse and handing off, allow for a great many more subscribers per system than traditional mobile telephone systems.

While cellular technology has been around for a number of years, commercial implementation of the technology had to receive approval by the Federal Communications Commission (FCC). Cellular service on a commercial scale was introduced in 1984. The FCC mandated that there be two systems operators per market area, one of which was designated a cellular subsidiary of the local telephone company. Awarding licenses for the other systems became chaotic, as the revenue potential became realized, and the FCC was flooded with applications. At the end of 1989 there were 510 systems on-line in 160 cities.

In general, the cellular industry consists of three segments: manufacturers of cellular telephones; manufacturers of cellular systems and system components; and operators of cellular systems. In addition, other segments have developed that feed off one or more of the three main sectors. One example is the cellular telephone reseller. This type of company markets to potential cellular subscribers and receives a commission from the system operator for every subscriber he or she signs up.

One dramatic development in 1990 was Motorola's announcement of plans for a new cellular network called Iridium. As envisioned by Motorola, this new cellular network will complement the existing terrestrial network, spanning the globe with 77 low-altitude satellites stationed in orbit around the earth to relay signals between callers. Motorola estimates the capacity of the system will be 10 million users. It will be especially useful in rural areas, where terrestrial cellular is not economical. Motorola is seeking partners around the world, but has already announced a date in 1992 for initial deployment of demonstration satellites. Full implementation is slated for 1994 with full service capabilities by 1996.

Cellular Market Review

The number of cellular subscribers in the United States has increased from 91.6 thousand in 1984 to 2.6 million in 1989 and is expected to soar to 18.1 million by 1995 (see Table 41).

Cellular telephones, originally marketed principally to business people, are becoming a consumer product. The prices of the phones themselves have decreased from $2,000-$4,000 per phone three or four years ago to $200-$500 today for a basic phone. Recent inroads made by producers in Hong Kong, Singapore, and South Korea indicate that the price of the phones is likely to fall further.

There are three different types of cellular telephones: mobile, used primarily in an automobile; transportable used either in an automobile or converted and carried in a pouch, and hand-held portable, "pocket-sized," to be used portably. According to industry estimates, the percentage of the market accounted for by mobile units will decrease from 69 percent in 1989 to 54 percent in 1995, while the proportion of hand-held portable units will increase from 19 percent to 40 percent during the same time period. The balance is accounted for by transportable units.

There are 15 suppliers of cellular phones to the U.S. market. The largest U.S.-based supplier is Motorola. Significant foreign-based suppliers include Toshiba, NEC, Panasonic, Uniden, Mitsubishi, and Oki. According to some industry sources, Motorola has the lion's share of the hand-held portable markets, with 35 percent. In the market for mobile units, no one producer has more than 15 percent of the market. In the transportable market, Motorola comes in a distant fifth with 10 percent, behind Panasonic (20 percent), Mitsubishi (15 percent), Uniden (13 percent), and Novatel (12 percent).

There are two principal suppliers of cellular systems in the U.S. marketplace: Motorola and AT&T. With roughly equal portions, Motorola and AT&T together account for over 80 percent of the number of systems installed. In general, AT&T has been more successful with the BOCs' cellular subsidiaries, while Motorola has been very successful with the nonLEC (nonwireline common carrier) market.

Annual capital investment costs of the cellular systems operators have increased from $234 million in 1984 to $700 million in 1987 (see Fig. 58). Service revenues have increased from $178 million in 1984 to $1.8 billion in 1989. The anticipated growth in revenue has spurred tremendous activity among franchise operators. Mergers and aquisitions have become commonplace. BOC cellular subsidiaries are crossing over into other BOC regions to become the competing carrier. BellSouth has been particularly aggressive in acquiring competing cellular franchises. The largest cellular carriers as of mid-1989 were BellSouth with 380,841 subscribers, PacTel with 361,000, McCaw with 335,000, Southwestern Bell with 333,000, and GTE with 220,000.

Aside from the price of the phones themselves, the other impediment to developing a mass market is the monthly price of the service. That too is dropping, although not quite as rapidly as the prices of the phones. The service is still generally more costly than regular telephone service, but as the number of subscribers increases, thereby reducing the marginal cost per subscriber, the cost of service will decrease.

In 1990, the cellular telecommunications network began to convert to digital technology. While the current analog systems have tremendous capacity compared to what was available before, there are practical limitations on the number of subscribers per system. For a given amount of radio spectrum, digital technology will allow the systems to have significantly more subscribers than analog systems. In addition, there are other technical factors that make digital technology superior to analog. Once the digital systems are in place, the marginal cost per subscriber is likely to decrease dramatically. At that point, it is projected that cellular will become a relatively inexpensive consumer product/service and according to industry sources may reach penetration levels of 50 percent of the population (Fig. 59). Industry sources estimate that by 1995, 80 percent of cellular phones will be digital, 10 percent will be dual mode, and 10 percent will be analog. Moreover, by that time business usage will account for some 55 percent of total cellular usage, and personal usuage will account for 45 percent.

The most prevalent users of cellular today are professionals, with 13 percent of total usage; next are sales personnel with 12 percent, followed by managerial personnel with 11 percent and housewives with 9 percent. In terms of businesses that use cellular, the largest category is business services with 35 percent, followed by retail with 14 percent, construction with 12 percent, and manufacturing with 8 percent.

Radio Paging Networks

In general, paging systems fall into two categories: low capacity, typically private systems used in environments such as hospitals and campuses; and high-capacity radio paging systems typically administered by the local telephone company or a radio common carrier. The types of messages that can be sent over the different systems include voice messages (available only in a low-capacity system), tones (or beeps), visual displays, or any combination thereof. Low capacity systems, which usually cannot have a subscriber base of more than about two hundred, frequently transmit tone and voice messages. High-capacity systems usually are able to support a subscriber base of several thousand.

While paging services are used throughout the economy, several sectors find such services particularly useful. Approximately one third of all pagers are used in service industries. The construction, transportation, utilities, and communications sectors are also large users, each accounting for about 15 percent of pagers in operation.

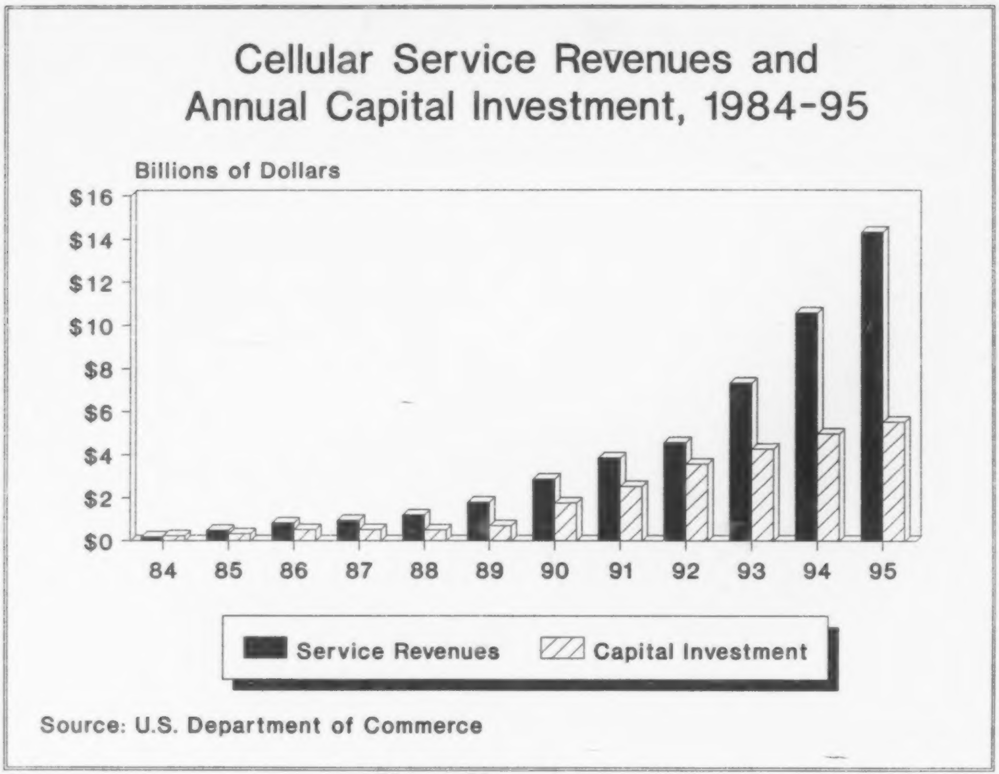
Paging Market Review

The annual market for radio pagers has increased steadily over the past several years from some 1 million pagers valued at $250 million in 1984 to almost 3 million pagers valued at $490 million in 1989. Annual sales are expected to amount to 8.2 million units valued at $790 million by 1995.

About 59 percent of the pagers in use are capable of numeric messages; about 25 percent of the pagers in use are capable of tone only; 12 percent combine tone and voice; and the balance are capable of full alphanumeric messages (see Fig. 60). The marketplace has become very competitive, with a number of suppliers jockeying for market share. The undisputed leader is Motorola, with 60 percent of the installed base (see Fig. 61). NEC is a distant second with 15 percent. Panasonic has about 5 percent and Multitone, through its Radio Shack sales, has garnered 3 percent of the market.

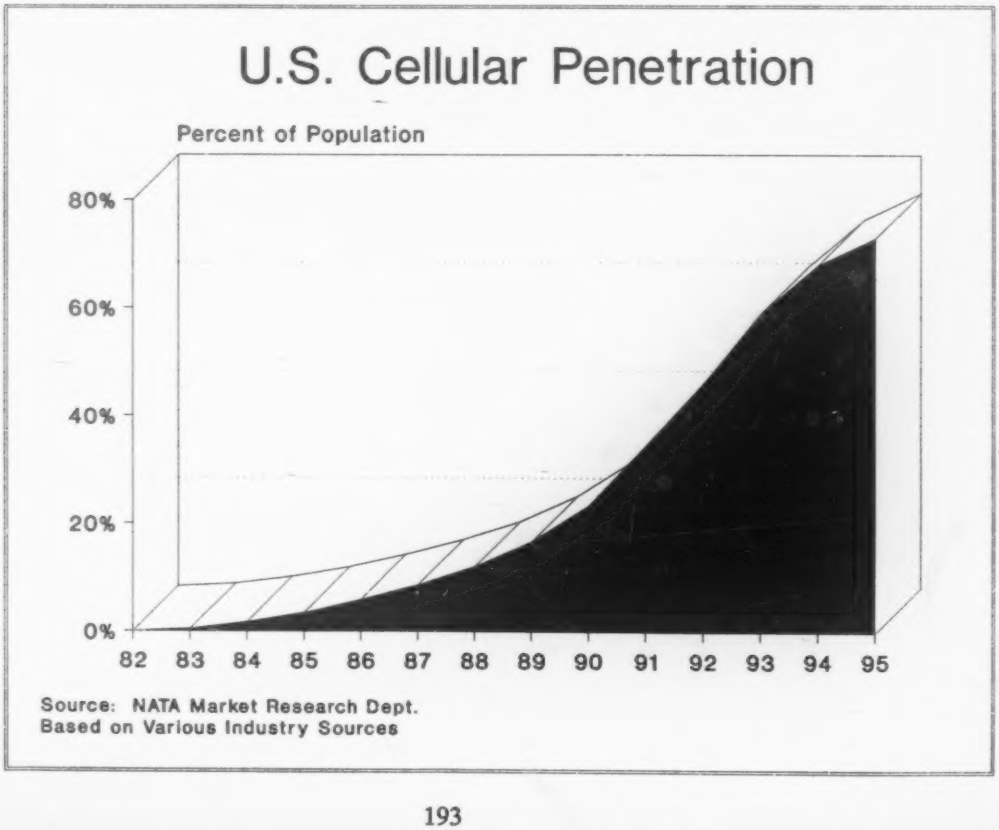
The market for radio pagers is likely to continue to be dynamic over the next several years, with the total number of subscribers expected to reach 28 million by 1995, up from 9.4 million in 1989. New growth will come as a result of innovative product design, as in the new wristwatch pager, and alternate channels of distribution, as in case of Multitone's success at selling through Radio Shack stores.

Figure 58



Source: U.S. Department of Commerce

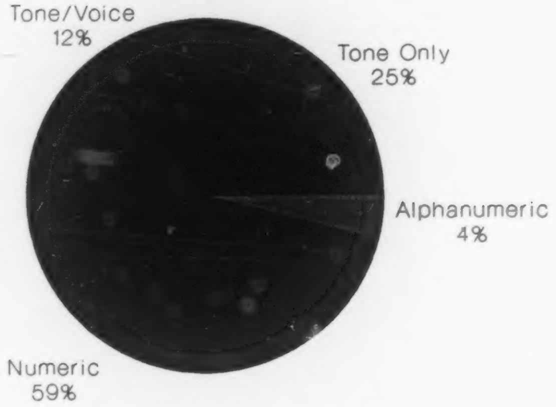
Figure 59



Source: NATA Market Research Dept.
Based on Various Industry Sources

Figure 60

1989 Pagers In Use, by Type

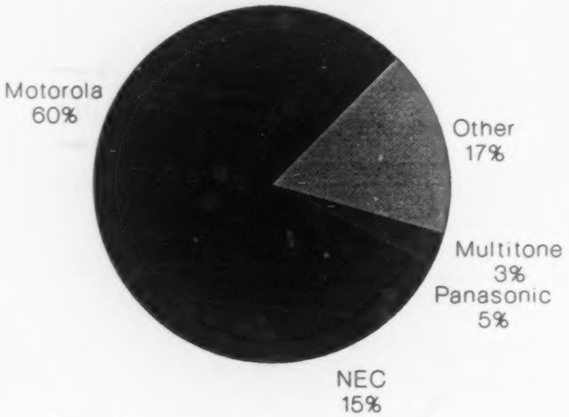


Total Pagers in Use = 9.4 Million

Source: TE&M, August 15,1989

Figure 61

1989 Pager Installed Base,
by Manufacturer Market Share



Total Pagers In Use = 9.4 Million

Source: NATA Market Research Dept.

Table 41

Mobile Communications Marketplace, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR*
							Percent
Radio Pagers:							
Annual Sales Value: $ millions	250	299	352	399	430	490	14.4
Annual Sales Volume: $ millions	1.0	1.3	1.6	1.9	2.3	2.8	22.9
Pagers In Use: millions	3.8	4.5	5.4	6.5	7.8	9.4	19.9
Cellular Marketplace:							
Telephones:							
Annual Sales Value: $ millions	187	575	785	875	1,013	1,456	50.8
Annual Sales Volume: thousands	75	280	393	475	675	1,120	72.0
Subscribers: thousands	92	340	682	1,100	1,775	2,577	10.0
Network Equipment:							
Annual Sales: $ millions	234	322	526	526	500	700	24.5
Systems on Line: Number	33	105	171	312	450	510	73.0
Service Rev.: $ millions	178	482	823	960	1,204	1,800	59.0
	1990(p)	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	CAGR*
							Percent
Radio Pagers:							
Annual Sales Value: $ millions	490	500	550	695	700	790	10.0
Annual Sales Volume: $ millions	3.2	4.0	4.7	5.6	6.8	8.2	21.0
Pagers In Use: millions	11.2	13.5	16.2	19.4	23.3	28.0	20.1
Cellular Marketplace:							
Telephones:							
Annual Sales Value: $ millions	1,773	1,877	1,905	2,034	2,371	2,452	6.7
Annual Sales Volume: thousands	1,760	2,175	2,715	4,519	6,775	8,950	38.4
Subscribers: thousands	4,020	5,235	7,536	10,043	14,778	18,100	35.1
Network Equipment:							
Annual Sales: $ millions	1,757	2,535	3,576	4,277	4,978	5,533	21.0
Systems on Line: Number	550	590	600	600	605	605	2.0
Service Revenue: $ millions	2,875	3,855	4,575	7,326	10,573	14,328	38.0

(r) Revised
(e) Estimated
* Compound Annual Growth Rate
(p) Projected

Source: Estimated by NATA Market Research Department based on various industry sources

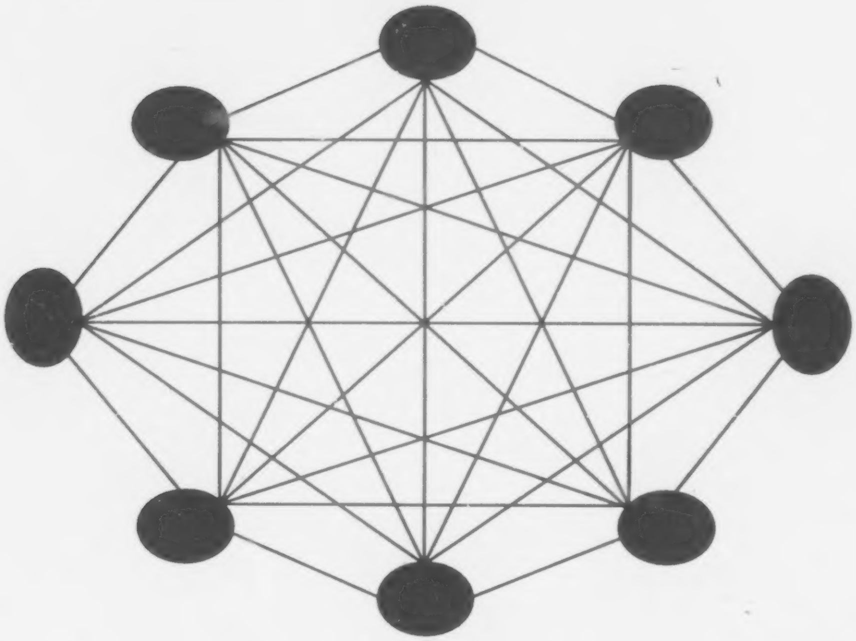
North
American
Telecommunications
Association

2000 M Street, N.W. Suite 550 • Washington, D.C. 20036 • 202/296-9800 • 800/538-6282 • Fax 202/296-4993

A8640-3.2U

1991 Second Edition

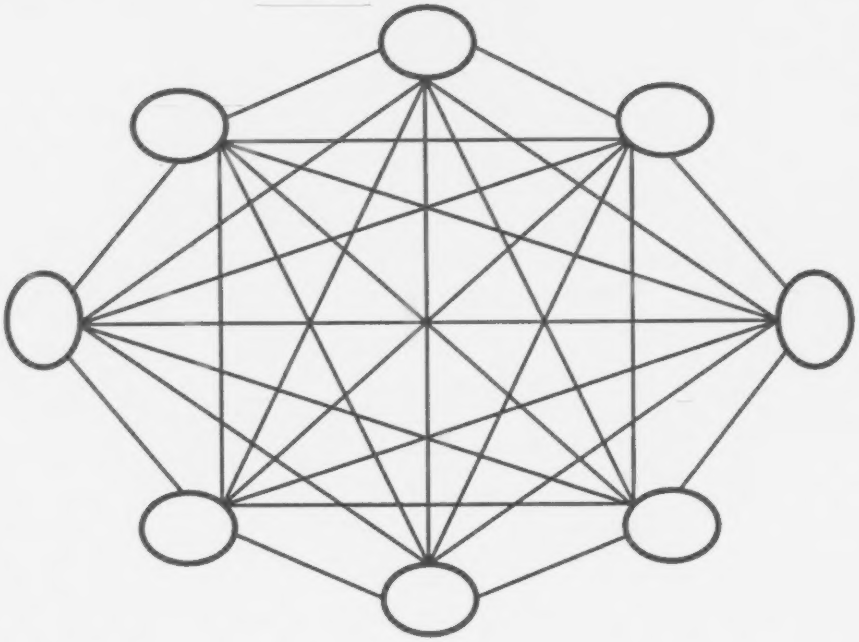
Telecommunications Market Review And Forecast



North American Telecommunications Association

1991 Second Edition

Telecommunications
Market Review
And Forecast



North
American
Telecommunications
Association

This year NATA has expanded its annual report on the telecommunications industry to include a second edition. The first edition covered all market segments previously included in the annual report and was released at the end of the year, when NATA has traditionally published this report. This second edition contains new sections on the interconnect industry and the emerging market for videoconferencing equipment. It also re-examines the 1990 results and 1995 forecasts contained in the first edition.

The second edition also marks a shift in the release date of this report from the end of the year to the second quarter of the year — a shift designed to bring information to the telecommunications industry on a more timely basis.

Research and Analysis

Eric G. Nelson
Mitchell B. Wander

Editorial Support

Mary Lou Coffman
Mary I. Bradshaw
Albert H. Kramer
Susan C. Ryba
Scott R. Silverman

Production Support

Mary Lou Coffman
Lee Biederman

Copyright© 1991 by the North American Telecommunications Association
2000 M Street, N.W., Suite 550
Washington, D.C. 20036
(202) 296-9800

ISBN 0-940919-20-6

Warning: It is against the law to copy all or any part of this publication without express written permission of NATA.

FOREWORD

Many of the technological developments of the 1990 telecommunications market will bring dramatic changes in the way residential and business consumers communicate. For instance, ISDN has become commercially available. Three RBOCs announced tariffs for ISDN trunks and business lines during 1990 and, late in the year, several telcos began ISDN trials to residential consumers. The latest technologies to capture the interest of business users and manufacturers include cordless/wireless communications and videoconferencing. Moreover, many of the more mature products such as fax, voice processing, and data communications were provided new applications. In short, the telecommunications marketplace is one where the only constant is change.

The North American Telecommunications Association (NATA) is uniquely positioned to ensure that the changes taking place in the telecommunications marketplace are rooted in an environment that promotes fair and open competition. NATA is a national trade association representing manufacturers and distributors of public and private communications, computer, and software products and systems, as well as related service and information providers. The Association was founded in 1970 by Tom Carter and other farsighted businessmen dedicated to the establishment and expansion of strong manufacturer and distributor industries independent of the Bell system. NATA is dedicated to the expansion of the United States business communications market for its members, and to the maintenance of healthy sales and support channels for users of business and public communications products and services.

Increasingly recognized as the best single industry source for vital market intelligence, *The Telecommunications Market Review and Forecast* contains statistical and analytical descriptions of the full range of telecommunications sectors. This second edition reflects revised industry data and trends released during early 1991. The report is based on data collected by the NATA Market Research Department from government and private sources and our own surveys. Market trends have been confirmed by numerous industry representatives and analysts. This report represents the best efforts of the NATA Market Research Department to prepare a useful guide to the complex and dynamic telecommunications market. NATA staff is available to answer any questions relating to the statistics or analyses presented in this study at (800) 538-6282 or (202) 296-9800.

Edwin B. Spievack
President

TABLE OF CONTENTS

Executive Summary

Industry Overview . . . 3

Customer Premises Equipment . . . 5

Network Equipment . . . 6

Telecommunications Services . . . 7

U.S. Telecommunications Equipment Manufacturing Industry . . . 13

Telecommunications Services Overview . . . 21

Local Exchange Market

Overview . . . 35

Regulated Local Exchange Companies . . . 37

Bypass . . . 38

CPE Distribution . . . 39

ISDN . . . 39

Service Pricing Regulatory Trend . . . 40

Enhanced Services . . . 40

Information Services . . . 40

Sales Agency . . . 40

International Opportunities . . . 41

Interexchange Market . . . 61

Network Equipment Market . . . 67

Customer Premises Equipment

Overview . . . 73

CPE Purchaser Profile . . . 73

ISDN . . . 73

Systems Integration 75
Secondary Equipment 75
Centrex CPE 77

Interconnect Industry Review

Caveat: About PBX Statistics 81
Overview 83
Industry Analysis 84
CPE Distributor Revenue Sources 85
CPE Distributor Expense Analysis 86
1990 Gross Profit Margin Analysis 86
1991 Financial Outlook 87
Popular Peripherals Sold in 1990 88
A Look to the Future 88

Selected CPE Markets

PBX/Centrex Market

Introduction 95
Market Review 98
PBX-Centrex Installed Base 98
Manufacturer Trends 100

Key/Hybrid Market

Introduction 114
Market Review 116
Installed Base 117

Data Communications Equipment Market

Introduction 125
Market Review 126

Facsimile Terminal Market

Introduction 129
Market Review 130

Call/Voice Processing Market

Introduction 134
Market Review 135

Public Payphone Market

Introduction 140
Market Review 142

Videoconferencing Market

Introduction 146
Market Review 147

Residential Telecommunications Market

Introduction 150
Market Review 151

Mobile Communications Market

Introduction 157
Cellular Radiotelephony 158
Cellular Market Review 159
Radio Paging Networks 161
Radio Paging Market Review 162

International Developments

U.S. Foreign Trade Activities Overview 167
Managing Telecommunications Trade 169
Implications of U.S. Policies 170
1992 Economic Integration of the European Community 171
Implications of Political Changes in Eastern Europe 173
Other International Trends 174

Index 181

Figures

1. Value of the U.S. Telecommunications Equipment Market, 1984-1995 5
2. Annual Growth Rates of U.S. Manufacturers' Shipments of Selected Telecommunications Equipment, 1984-1990 13
3. Manufacturers' Shipments, Material Costs, and Year-End Inventories of Telecommunications Equipment 14
4. Comparison of Domestic, Import, and Export Prices for Telephone and Telegraph Equipment, 1985-1989 15
5. 1990 Telecommunications Services Market by Type of Service 21
6. RBOC ISDN Trials and Commercial Offerings 24
7. RBOC Lines with ISDN Access, 1991 vs. 1994 30
8. 1990 Local Exchange Services Market by Type of Service 35
9. 1990 RBOC Revenue by Source 36
10. 1990 Revenue Breakdown by RBOC 37
11. 1990 Net Income by RBOC Revenue 38
12. Enhanced Services Scoreboard 42
13. 1990 Long Distance Market by Carrier 61
14. 1990 Long Distance Market by Type of Service 62
15. 1990 Central Office Switch Market by Manufacturer 67
16. Network Equipment Market, 1984-1995 68
17. 1990 CPE Market by Distribution Channel 83
18. 1989 CPE Distributor Revenue by Source 84
19. 1990 CPE Distributor Revenue by Source 85
20. 1989 CPE Distributor Expenses by Type 86
21. 1990 CPE Distributor Expenses by Type 87
22. 1990 Gross Profit Margin by Business Segment 88
23. Anticipated Change in Profit Margins, 1990-1991 89
24. Confidence Ratings in Regional Economies 90
25. Anticipated Change in Revenue, 1990-1991 90
26. 1990 Popular Peripheral Equipment 91
27. PBX-Centrex Price Comparison over a Five-Year Period for a 50-Line System 96
28. 1989 User Satisfaction Ratings of PBXs by Manufacturer 97
29. 1989 User Satisfaction Ratings of Centrex Services by RBOC 97
30. PBX Market by System Size, 1984-1995 98
31. PBX Shipments by Distribution Channels, 1989-1990 99

32. PBX-Centrex Installed Base Development, 1984-1995 99
33. 1990 PBX-Centrex Lines Installed, by RBOC Region 100
34. 1990 RBOC Share of PBX Market Within Own Region 101
35. 1990 PBX Market Penetration by Industry 101
36. 1989 Centrex Market Penetration by Industry 102
37. PBX Prices per Line, 1984-1995 103
38. 1990 PBX Distribution Channels by Company 103
39. 1990 Manufacturer Market Shares of PBX Line Shipments 104
40 1990 Vendor Control of Installed PBX Customer Base 105
41. 1990 PBX Shipments by Type of Installation 106
42. PBX Feature Usage 107
43. Total Key Station Shipments, 1984-1995 114
44. Key/Hybrid Station Shipments by Type, 1984-1995 115
45. Key/Hybrid Shipments by Distribution Channel, 1989-1990 116
46. Key/Hybrid System Installed Base, 1984-1995 117
47. 1989 Key System Market by Industry 118
37. Key/Hybrid Manufacturer Market Share of Stations Shipped, 1989-1990 119
49. 1990 RBOC Share of Key Systems Market Within Own Region 119
50. 1990 Key Systems Distribution Channels by Company 120
51. 1990 Vendor Control of Key/Hybrid Installed Base 120
52. 1990 Key/Hybrid Shipments by Type of Installation 121
53. Data Communications Equipment Market, 1984-1995 127
54. Facsimile Terminal Market by Group, 1984-1995 129
55. 1990 Facsimile Terminal Distribution Channels 130
56. 1990 Facsimile Terminal Manufacturer Market Shares by Units Shipped 131
57. 1990 Facsimile Terminal Penetration by Industry 132
58. Call/Voice Processing Equipment Market by Type, 1984-1995 135
59. 1990 Voice Messaging Equipment Market by Vendor 136
60. 1990 Voice Response Equipment Market by Vendor 136
61. 1990 Stand-Alone ACD Market by Vendor 137
62. Public Payphone Installed Base, 1984-1995 142
63. 1988 BOC-Owned vs. NonLEC-Owned Payphones by Region 143
64. BOC Revenues from Payphones, 1984-1995 144

65. Two-Way Videoconferencing Market, 1988-1991 147
66. Residential Telecommunications Market, 1984-1995 150
67. Corded Telephone Instrument Market by Type, 1984-1995 151
68. Cellular Service Revenues and Annual Capital Investment, 1984-1995 157
69. U.S. Cellular Penetration, 1982-1995 158
70. 1990 Pagers in Use by Type 159
71. 1990 Pager Installed Base by Manufacturer Market Share 160
72. U.S. Trade Balance in Telecommunications Equipment, 1984-1988 167

Tables

1. Value of Selected U.S. Telecommunications Equipment Markets, 1985-1995 9
2. Value of U.S. Manufacturer Factory Shipments of Selected Telecommunications Equipment, 198-1990 17
3. Industry Data Related to the Production of Telecommunications Equipment 17
4. 1988 Selected Operating and Financial Ratios for Communications-Related Industries 18
5. Various Price Indexes for Certain Telecommunications Equipment, 1985-1990 18
6. Annual Rate of Change in major Price Indexes for Telecommunications Services 31
7. Residential and Business Telephones Installed in Top 30 Metropolitan Areas, 1985, 1990, and 1995 44
8. The Top 150 Largest Telephone Companies Reporting to USTA, including Holding Companies 45
9. Selected Financial Information of the Regional Bell Operating Companies as of December 31, 1990 48
10. Selected Financial Information of Carriers as of December 31, 1990 49
11. Advanced Technology Deployment by Regional Bell Operating Companies,1990 and 1994 50
12. Outside Plant Statistics of Reporting Local Exchange Companies as of December 31, 1990 51
13. Switched Access Lines by Type of Technology of Reporting Local Exchange Companies as of December 31, 1990 55
14. Access Lines by Type of Customer of Reporting Local Exchange Companies as of December 31, 1990 56

15. Telephone Calls and Minutes of Reporting Local Exchange Companies as of December 31, 1990 57
16. Interexchange Revenues and Market Shares of Major Service Providers, 1985-1990 64
17. 1989 Long Distance Market by Industry Segment 64
18. Network Equipment Market, 1984-1995 70
19. Business CPE Sales by Product, 1988-1991 92
20. PBX Sales by System Size, 1984-1995 108
21. PBX Installed Base and Annual Sales for the Top 30 Metropolitan Areas, 1985, 1990, and 1995 109
22. Centrex-PBX Installed Base Development, 1984-1995 110
23. PBX-Centrex Lines in Place by Regional Bell Operating Company, 1986-1990 111
24. 1990 PBX-Centrex Penetration by Industry 111
25. PBX Prices per Line, by System Size, 1984-1995 112
26. Estimated Revenue for Major PBX Manufacturers, 1986-1989 112
27. 1990 PBX Manufacturer Market Shares by Lines Shipped, by System Size 113
28. PBX Shipments by Manufacturer Distribution Channels 113
29. Key Systems Market, 1984-1995 122
30. Key/Hybrid Shipments by Manufacturer Distribution Channel, 1986-1990 123
31. Installed Base of Key/Hybrid Market, 1984-1995 123
32. 1989 Key System Penetration, by Industry 124
33. Key/Hybrid Manufacturer Market Shares by Stations Shipped, 1988, 1989, and 1990 124
34. Data Communications Equipment Market, 1984-1995 128
35. Facsimile Terminal Market, 1984-1995 133
36. Voice/Call Processing Market, 1984-1995 139
37. Public Payphone Marketplace, 1984-1995 145
38. Teleconferencing Market, 1988-1991 149
39. Residential Telecommunications Market, 1984-1995 153
40. Mobile Communications Market, 1984-1995 163
41. U.S. Imports of Telecommunications Equipment, 1985-1990 178
42. U.S. Exports of Telecommunications Equipment, 1985-1990 179

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Industry Overview

The U.S. telecommunications network is comprised of 15,000 central office switches, more than a billion miles of transmission lines, almost as many miles of special service circuits, and 135 million access lines connecting customers to the public switched telephone network. The U.S. telecommunications marketplace is unique in the world for its size, sophistication, and diversity.

The total U.S. market for telecommunications equipment has grown by a compound annual growth rate of more than 9 percent a year, from $20.9 billion in 1984 to $35.2 billion in 1990. Preliminary projections suggest the market will continue apace through the first half of the 1990s and grow at slightly more than 9 percent a year, to $54.6 billion, by 1995.

The growth in the telecommunications equipment market is being stimulated by a number of factors — some already in place, others about to be. Satellite and data communications systems, cellular mobile radio systems, and fiber optic transmission systems are being integrated into the conventional voice network, which is increasingly being converted from analog to digital systems. Most of this conversion has taken place in the transmission of signals between switches. Digitization has vastly expanded the capacity of the network for the increasing demands placed on it. One of the most significant vehicles for this increased capacity is anticipated to be a completely digital Integrated Services Digital Network (ISDN). ISDN combines voice, data, and video transmission in one network, giving users tremendous communications flexibility. While some users may continue to prefer achieving ISDN capabilities through existing network and CPE offerings, the implementation of ISDN will create a vast market for compatible products and services. Some estimates put the market for ISDN-related equipment alone at about $10 billion by 1995.

In general, the telecommunications marketplace represents a compromise between what users demand and what technology can provide. A company's telecommunications network is viewed increasingly as a strategic business asset with expanding responsibilities for increasing revenue and decreasing costs. Users are growing more sophisticated in the demands they make on public and private networks. They see new services such as voice messaging, audiotex, 900, videoconferencing, packet switching, computer-to-telephone links, etc., as having a real impact on their profitability and are examining them aggressively to determine which products and services best match their specific needs. This heightened user awareness provides tremendous opportunities for vendors.

The U.S. telecommunications marketplace is the largest in the world and, since the AT&T divestiture, one of the most open. This openness has led to intense competition from both domestic and foreign suppliers. In 1990, approximately 22 percent of the U.S. telecommunications equipment market was supplied from abroad, up from 17 percent in 1984. This influx of foreign equipment has caused friction in the international telecommunications trade environment, because U.S. producers are not usually provided the same market access abroad as foreign suppliers are provided in the United States.

A manifestation of this friction occurred in early 1989, when the United States Trade Representative determined that Japan had breached a 1986 agreement designed to open the Japanese market to foreign suppliers. The imposition of retaliatory sanctions on certain Japanese-made products was narrowly averted when the Japanese agreed to various concessions. A similar, albeit not quite so dramatic, situation developed in 1990. Early in the year, the U.S. entered into trade negotiations with Japan to avert a crisis similar to the one in 1989. These negotiations led to an agreement obviating sanctions. The terms of the agreement call for Japan to open its market for value added telecommunications services and specialized data communications equipment.

On other fronts, the U.S. government has actively promoted free trade and has initiated several measures to that end. Included are the implementation of a free trade agreement with Canada, creating the largest trading block in the world, and participation in a new round of multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT), the international organization tasked with managing the free world's trading system. (In December of 1990, the GATT negotiations broke down over European agricultural subsidies, but negotiations were resumed in 1991.)

While the U.S. telecommunications marketplace presents tremendous opportunities for equipment and services providers, it is also a marketplace that requires intense study because of its complexity and fiercely competitive nature. Not all bandwagons are destined to succeed. Certain firms and sectors within the industry will not survive. Acquisitions and mergers are commonplace in the industry; during 1989 there were over 100. Distributors were key targets of the acquisition trend, as manufacturers and carriers sought to secure stable outlets for their products and profitable aftermarket sales. This trend continued in 1990, with over 250 mergers and acquisitions, including several high-profile acquisitions such as Mitel's purchase of Coradian. In other parts of the industry, MCI acquired Telecom*USA, GTE bought Contel, Northern Telecom acquired the balance of U.K.'s STC, AT&T purchased NCR, and Siemens and Stromberg-Carlson are combining their U.S. CO switch operations.

The bulk of the market for telecommunications equipment and services is comprised of purchases by private businesses, common carriers, and residential consumers. Other important market segments include the government and private carriers.

Overall, corporate users increased their 1990 telecommunications budgets by 8 percent over 1989. In 1989, expenditures for voice communications represented 57 percent of total telecommunications expenditures, while data communications accounted for 43 percent. In 1990, voice accounted for 55 percent, while data was up to 45 percent. This trend is likely to continue as distributed processing of information becomes more prevalent and communication of data becomes an increasingly essential part of business activity.

Many business users are turning to private networks to address their telecom needs. The industries most often employing this tactic to increase their business efficiencies include manufacturing, with an estimated 8,000 private networks, wholesale/retail, with about 5,000, and financial institutions with almost 3,500.

Telephone common carriers are also increasing their expenditures. In 1990, new investment by local exchange carriers in plant and equipment (including investment in other than telecommunications equipment) amounted to $20.5 billion, an increase of three and a half percent over 1989. Added to that, in 1990 long distance carriers spent nearly $18.0 billion on new plants and equipment, up almost five percent from 1989. In total, telephone common carriers (excluding private network carriers) spent $38.5 billion on plant and equipment. Common carrier construction spending in 1990 amounted to $41 billion. This gradual growth in spending is likely to increase through the mid-1990s, as carriers upgrade their networks to implement ISDN and other advanced network services.

Spending by the U.S. government on telecommunications remained fairly stable, in 1990 amounting to some $5.8 billion. The largest telecom budgets were in the Defense Department at $2.1 billion and the Department of Transportation at $1.5 billion. The next largest budget was for the Department of the Treasury at $258 million. No other agency spent more than $175 million.

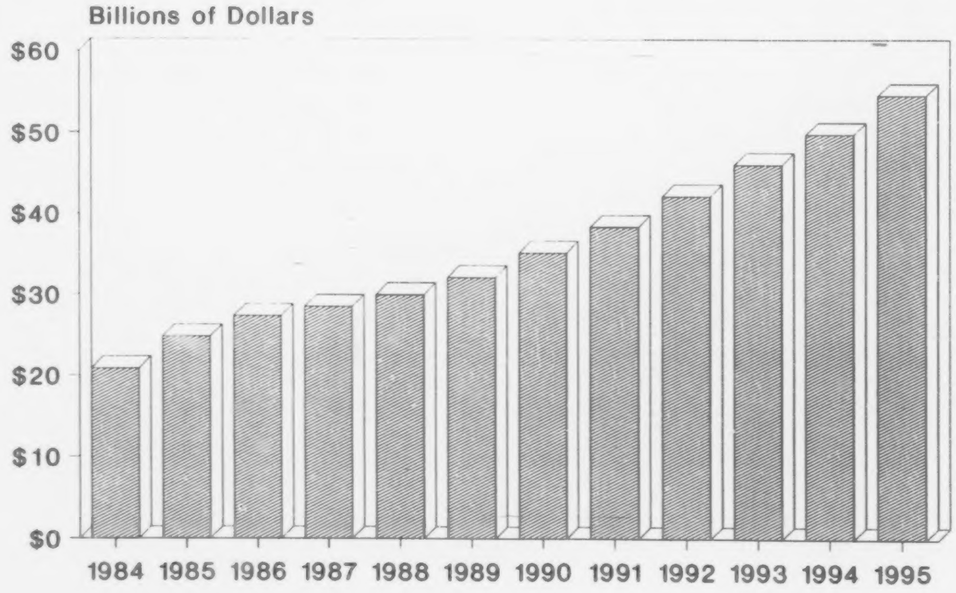
Residential users are also increasing their purchases of telecommunications equipment. Retail consumer purchases increased from $3.0 billion in 1989 to $3.3 billion in 1990. The residential segment of the marketplace is likely to continue to grow moderately through the mid 1990s.

Customer Premise Equipment

The business telecommunications market (including government purchases) grew rapidly during 1987-1990, jumping from $13 billion to $20 billion. Much of this growth is due to the soaring data communications equipment market, rising from $5.1 billion in 1987 to $8.8 billion in 1990. This segment will continue to expand at a brisk pace as distributed

Figure 1

Value of Selected U.S. Telecommunications Equipment Markets, 1984-1995



Source: NATA Market Research Department

processing becomes ubiquitous and remote data entry, such as credit card validation and point-of-sale terminals, becomes increasingly popular.

Other segments of the business telecommunications market experiencing rapid growth include the facsimile terminal and voice processing markets. The fax market exploded from $821 million in 1987 to almost $4.0 billion by 1990. Faxing has become an essential part of business communications, and the office without fax capability is becoming an anomaly. New technologies that allow fax terminals to be connected to personal computers, allow faxes to double as photocopiers and/or printers, and increase the speed of fax transmission continue to boost the market. Voice processing, principally voice messaging and voice response systems, is also being rapidly accepted in the business workplace as a means of increasing efficiency and customer satisfaction and of generating revenue. The market for voice processing equipment jumped from over $800 million in 1987 to more than $2.2 billion in 1990. It is expected to grow rapidly in the near term as business customer acceptance of "talking to a machine" continues to grow.

The traditional segments of the customer premises market — PBXs and key systems — have not fared as well. Due to intense competitive pressures and the recession, the value of the PBX market decreased somewhat from $3.1 billion in 1987, stabilized at $2.9 billion in 1988 and 1989, and further declined to $2.6 billion in 1990. This lackluster performance is likely to improve slightly during the early 1990s, as customers who bought in the great buying spree of 1984 and 1985 begin to replace their systems, and as ISDN standards are implemented, stimulating the popularity of ISDN-compatible PBXs. In the key system market, total sales increased marginally from $960 million in 1987 to $965 million in 1988. Toward the end of 1989, prices began to firm as a result of the AT&T dumping case, an important trade action filed by AT&T against Japanese, Taiwanese, and Korean producers. This price stabilization helped boost the market to $995 million in 1989 and to just over $1.0 billion in 1990.

Other factors affecting the PBX and key market include the revitalization of centrex (a service that competes in functionality with PBXs) by telephone companies and the growth of the secondary equipment market, *i.e.*, the market for surplus, used, and refurbished equipment. The secondary equipment market has grown from practically nothing a few years ago to over $510 million by 1990, although this figure is in dispute and some suggest annual sales do not exceed $150 million.

The residential telecommunications market, principally corded and cordless telephones and answering machines, continues to expand, growing from $2.3 billion in 1987 to $3.3 billion in 1990. The most significant growth occurred in the cordless telephone segment of the market, which rose from $355 million in 1987 to $515 million in 1990.

Network Equipment

The U.S. market for telecommunications network equipment consists of purchases by telephone companies and other companies for private networks. The total market for such equipment grew from $8.2 billion in 1987 to $9.5 billion in 1990. This growth is due, in part, to the increasing use of cellular telephone systems. Annual capital expenditures of cellular common carriers increased from $234 million in 1984 (the year cellular radiotelephone service was authorized by the Federal Communications Commission [FCC]) to $526 million in 1987, and to $1.8 billion by 1990. In addition, telephone common carriers have been upgrading many of their central offices for implementation of ISDN trials.

The market for central office (CO) switches expanded irregularly from $2.9 billion in 1984 to $5.5 billion in 1986, before declining slightly to $5.0 billion in 1990. As cellular telephone systems convert from analog to digital technology during the 1990s, and as implementation of ISDN and other advanced services progresses, the market for CO switches will accelerate and is projected to rise to $7.3 billion by 1995. Digital CO switches increasingly, used for wireline networks and under development for cellular systems, have begun to compete successfully with PBXs in offering such advanced features as voice mail, speed calling, conferencing, call forwarding, call waiting, and CO-based local area networks.

Another important growth segment of the network equipment market is fiber optics, a relatively low cost, very high capacity medium. The market for fiber optics in the United States more than doubled from $410 million in 1984 to $883 million in 1986, and doubled again to $1.7 billion in 1988. By 1990, the market reached $2.1 billion. The explosive growth in fiber optics has been due principally to purchases by long distance carriers. Most carriers have now replaced the majority of their networks with fiber optics, so long distance carriers' purchases will no longer provide the impetus for such rapid growth. Local exchange carriers are beginning to lay fiber in the local loop, but principally to new businesses. Retrofitting to existing businesses will come slowly but will provide some growth potential. For cost reasons, retrofitting fiber to the home is not likely to occur in this decade. One of the most promising growth areas for fiber optics is local area networks (LANs). For a variety of reasons, fiber is increasingly the LAN medium of choice.

Telecommunications Services

The U.S. telecommunications network links telecommunications and computer equipment for voice, text, data, and video transmission. About 85 percent of the traffic on the domestic public network is voice; data accounts for roughly 10 percent; and video and other specialized services account for the remainder. About 550 billion calls are placed each year over the public network. On average, each person makes more than 2,200 calls a year, or more than six calls a day. Businesses account for about 20 percent of long distance domestic telephone use; residential users use 71 percent, and government and specialized users make up the rest. There are more than 220 million telephones in use in the United States, with about 93 percent of all households having telephone service.

There are currently more than 125 million access lines in the United States — 70 percent dedicated to residential use, 28 percent for business use, and the balance for specialized use.

Common carriers are the principal providers of telecommunications services. This type of company is obliged to provide service to customers on a nondiscriminatory basis. Common carriers can generally be divided into two types — local exchange companies and interexchange companies.

For the most part, local exchange companies are comprised of two general groups — the 22 Bell companies, spun off by the 1984 divestiture of AT&T and grouped into seven regional holding companies, and independent telephone companies. Local telephone companies had total revenues from all sources of approximately $120 billion in 1990, up three percent over 1989.

Interexchange companies provide long distance services. The top three interexchange carriers, which collectively account for over 90 percent of the long distance market, are AT&T, MCI, and U.S. Sprint. The total market for long distance services amounted to almost $52 billion in 1990, a two percent increase over 1989.

Implementation of ISDN is one of the key potential growth factors for the telecommunications services market. While ISDN trials were launched in 1988, general implementation on a commercial basis is just beginning. ISDN to the home will probably not occur before the turn of the century or later. For business users, ISDN will provide a great variety of features currently unavailable from the public network. It will allow simultaneous transmission of voice, data, and video over a single transmission path. In addition, features traditionally available only with a sophisticated PBX will be available to all ISDN users.

Aside from the promise of new services with the implementation of ISDN, the traditional telecommunications service business is no longer limited to basic telephone and telegraph services. Due to the convergence of voice and data in both technology and market structure, the industry now provides such services as computerized data transmission, electronic mail, videoconferencing, videotext, database access, software-defined "virtual" networks, "800" service, "900" service, teleconferencing, facsimile, voice messaging and other voice processing, call forwarding, call screening, environment control, and remote control of security devices.

Table 1

Value of Selected U.S. Telecommunications Equipment Markets, 1985-1995

($ millions)

Equipment	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*
Private Branch Exchanges	2,843	3,086	3,105	3,050	2,928	2,875	0.2
Central Office Switches	2,900	4,750	5,500	5,100	5,050	4,975	11.4
Key/Hybrid Telephone Systems	1,039	955	957	960	965	995	-0.9
Telephone Sets (all types)	1,200	1,585	1,685	1,750	1,825	1,875	9.3
Facsimile Equipment	175	164	260	821	1,825	2,887	75.2
Modems	1,100	1,266	1,500	1,650	1,840	2,025	13.0
Multiplexers (including T-1)	550	613	700	840	910	1,005	12.8
Local Area Network Equipment	300	450	700	800	1,025	1,450	37.0
Fiber Optic Equipment	410	500	883	1,011	1,650	1,990	37.2
Radio Communications Equipment (mobile radio systems and radio communications links)	3,500	3,750	3,970	4,250	5,000	5,110	7.9
Other Telecommunications Equipment	6,835	7,665	8,102	8,286	6,972	6,948	0.3
Total Telecom Equipment	20,852	24,784	27,362	28,518	29,990	32,135	9.0

Equipment	1990	(p) 1991	(p) 1992	(p) 1993	(p) 1994	(p) 1995	1990-95 Percent CAGR*
Private Branch Exchanges	2,590	2,552	2,787	3,219	3,285	3,400	5.6
Central Office Switches	5,010	5,250	5,686	6,210	6,965	7,250	7.7
Key/Hybrid Telephone Systems	1,025	1,100	1,125	1,175	1,250	1,275	4.5
Telephone Sets (all types)	1,890	1,975	2,100	2,250	2,375	2,863	8.7
Facsimile Equipment	3,850	4,457	4,958	5,361	5,723	6,476	11.0
Modems	2,450	2,785	2,850	2,875	2,850	2,625	1.4
Multiplexers (including T-1)	1,210	1,260	1,375	1,425	1,460	1,550	5.1
Local Area Network Equipment	2,020	2,210	2,251	2,375	2,550	2,685	5.9
Fiber Optic Equipment	2,075	2,375	3,520	4,300	4,950	5,810	22.9
Radio Communications Equipment (mobile radio systems and radio communications links)	5,775	6,977	7,450	8,326	9,125	10,320	12.3
Other Telecommunications Equipment	7,317	7,468	8,077	8,589	9,302	10,344	7.2
Total Telecom Equipment	35,212	38,409	42,179	46,105	49,835	54,598	9.2

* Compound Annual Growth Rate
(p) Projection

Source: NATA Market Research Department

U.S. TELECOMMUNICATIONS EQUIPMENT MANUFACTURING INDUSTRY

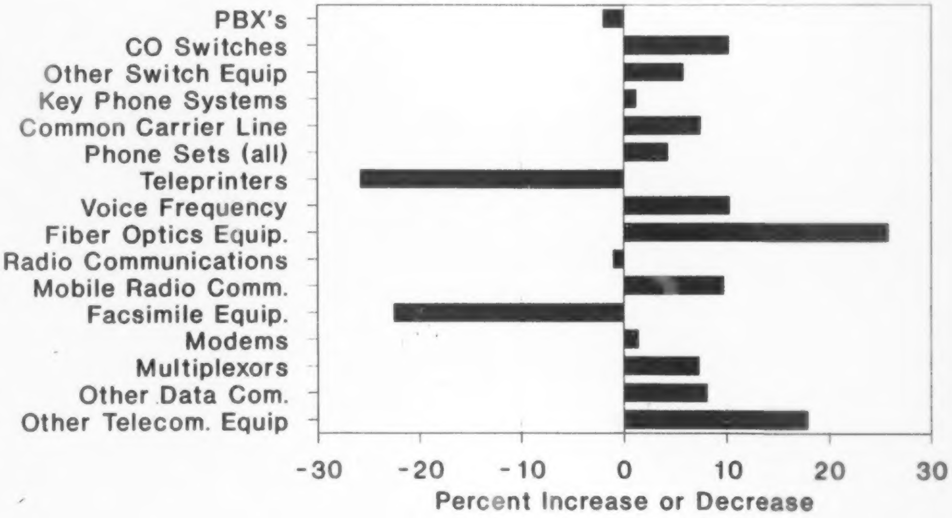
U.S. TELECOMMUNICATIONS EQUIPMENT MANUFACTURING INDUSTRY

The U.S. telecommunications equipment manufacturing industry typically focuses on the production of high-end, high-technology products. Much of the manufacture of consumer-oriented, relatively low-end products is conducted abroad and imported. U.S. factory shipments of all types of telecommunications equipment increased from $19.4 billion in 1984 to $22.9 billion in 1985 and to $28.7 billion in 1990 (Fig. 2 and Table 2, page 17). Most segments show some positive growth, with the notable exception of facsimile terminals. Despite an exploding market, U.S. manufacturers have virtually stopped fax production. The only area of the fax marketplace U.S. producers are addressing is the market for PC fax boards. These devices are board-level components that can be inserted in a personal computer to allow PC-to-fax communications. PC boards currently represent a relatively small part of the overall fax market.

Central office (CO) switches are the most significant product area for U.S. producers, accounting for 17 percent of total manufacturers' shipments in 1990. Other significant product areas in 1990 included data communications

Figure 2

Annual Growth Rates of U.S. Manufacturers' Shipments of Selected Telecommunications Equipment, 1984-1990



Source: U.S. Department of Commerce

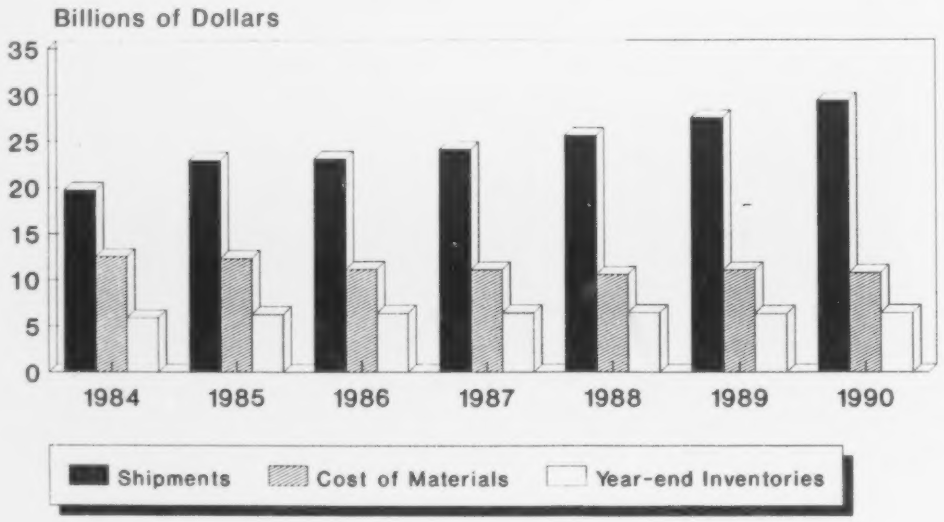
equipment (16 percent), mobile radio communications systems (11 percent), common carrier line equipment (10 percent), miscellaneous switching equipment (7 percent), PBXs (5 percent), and radio communications links (6 percent). Miscellaneous products and parts account for the balance.

The relative health of the industry can be analyzed by reviewing such information as inventories, capital expenditures, etc. (Fig. 3 and Table 3, page 17). Some indicators point to a rather healthy industry. Year-end inventories increased slightly from 1988 to $6.3 billion in 1989 to $6.4 billion in 1990 and, as a share of production, decreased from 23 percent to 22 percent. Other positive factors include the decreasing cost of materials. As a percentage of shipments, the cost of materials has decreased from 40 percent in 1989 to 37 percent in 1990. In addition, as a share of the value of shipments, total wages have been rather stable for the past several years. These indicators point to a rather healthy industry. Moreover, the industry is operating at a higher productive capacity than either the computer industry or the average for the manufacturing industry as a whole.

Other operating and financial ratios, however, suggest that the communications manufacturing industry, while healthy, is perhaps not as robust as the office equipment and services industry (Table 4, page 18). For instance, expenditures on research and development as a percent of net sales in the telecommunications equipment industry averaged 3.6 percent compared to 7.9 percent

Figure 3

Manufacturers' Shipments, Material Costs, and Year End Inventories of Telecommunications Equipment, 1984-1990



Source: U.S. Department of Commerce

in the office equipment and service industry. The current and quick ratios for communications equipment were 1.0 and 0.8 percent, respectively, compared to 1.7 and 1.0 percent, respectively, for the computer industry. Return on equity amounted to 4.3 percent and 14.3 percent for the telecommunications and computer industries, respectively.

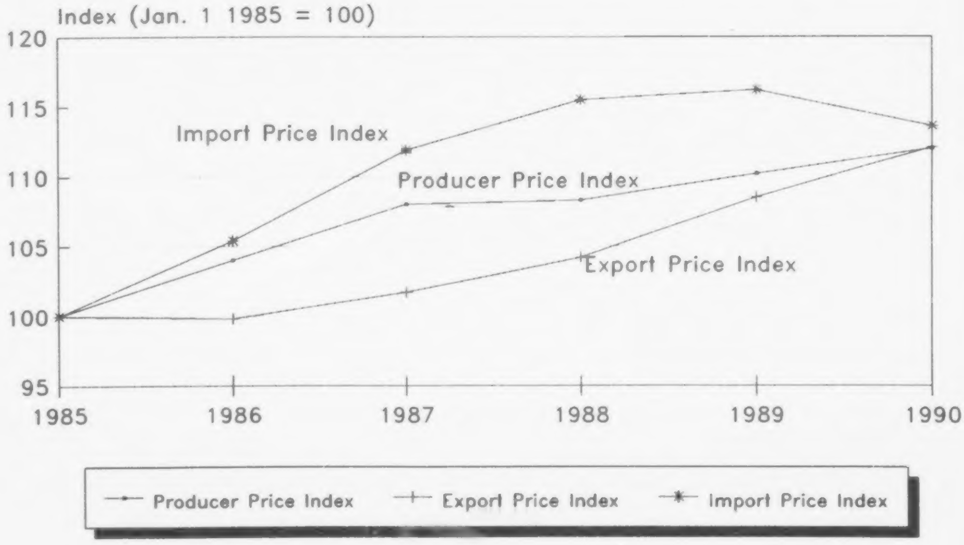
In general, the communications industry is becoming increasingly more efficient than the U.S. manufacturing sector as a whole, although it is not as robust in terms of profitability as certain specific industries such as the computer/office equipment industry. It is likely that the trend toward increased efficiency will continue in the near future and that capital expenditures will rise as the industry prepares for the wide-spread implementation of ISDN and the arrival of the age of digital communications.

Despite a generally positive scenario for the industry as a whole, it is clear that U.S. makers of certain products are not faring well financially. This is especially true for U.S. producers of commodity, consumer-oriented products. In general, the closer the product is to the mass market, the more difficult it is for U.S. producers to maintain profitability.

The trend in prices producers charge for their equipment for the first wholesale transaction varies by product (Fig. 4 and Table 5, page 18). Overall, for all telephone and telegraph equipment (not including radio equipment or fiber optic systems), prices increased 12 percent from 1985 to 1990. Prices of CO switches increased 8 percent from 1985

Figure 4

Comparison of Domestic, Import, & Export Prices for Telephone and Telegraph Equipment, 1985-1990



Source: Bureau of Labor Statistics

to 1987 before decreasing and, by 1990, amounted to just slightly above 1985 prices. Prices of telephone sets, the segment with the most price sensitive demand, decreased 9 percent between 1985 and 1990.

Prices for exports of U.S.-made telephone equipment and accessories increased more than 12 percent between 1985 and 1990, while import prices increased irregularly by more than 13 percent during that time period.

Table 2

Value of U.S. Manufacturer Factory Shipments of Selected Telecommunications Equipment, 1985-1990

Equipment	1985	1986	1987	1988	1989	1990(e)	1985-89 Percent CAGR*
Private Branch Exchange	1,721	856	1,222	1,300	1,450	1,389	-4.2
Central Office Switches	4,333	4,472	4,442	4,500	4,650	4,733	1.8
Other Switching Equipment	1,661	1,852	1,816	1,850	1,865	1,920	2.9
Key Telephone Systems	880	876	882	878	950	968	1.9
Common Carrier Line Equipment	2,329	2,833	2,737	2,745	2,750	2,867	4.2
Telephone Sets (all types)	1,219	790	1,003	1,025	1,050	1,012	-3.7
Teleprinters	474	361	325	175	150	113	-25.0
Voice Frequency Equipment	328	243	196	150	175	150	-14.5
Fiber Optics Equipment	529	637	701	755	800	887	10.9
Radio Communications Link	1,953	1,887	1,765	1,543	1,600	1,522	-4.9
Mobile Radio Comm. Systems (including cellular radio systems)	1,782	2,139	2,567	2,772	2,890	3,261	12.8
Facsimile Equipment	64	49	38	23	28	23	-18.7
Data Communications Equipment:							
Modems	1,047	1,229	1,078	1,155	1,200	1,242	3.5
Multiplexers	1,644	1,750	1,801	1,892	2,000	2,100	5.0
Other Data Comm. Equipment	648	765	972	1,180	1,225	1,436	17.3
Other Telecommaications Equipment	2,305	2,276	2,455	3,598	4,550	5,393	18.5
Total Telecom. Equipment	22,917	23,015	24,000	25,541	27,433	28.695	4.6

* Compound Annual Growth Rate

(e) Estimate for 1990 based on CAGR 1985-1989

Source: U.S. Department of Commerce

Table 3

Industry Data Related to the Production of Telecommunications Equipment, 1985-1990

Item	1985	1986	1987	19F	1989	1990(e)	1985-89 Percent CAGR*
Shipments: $ millions	22,917	23,015	24,000	25,541	27,433	28,695	4.6
Year-end Inventories: $ millions	6,250	6,336	6,375	6,410	6,300	6,313	0.2
New Capital Expenditurers: $ millions	1,246	1,123	1,175	1,238	1,450	1,506	3.9
Cost of Materials: $ millions	12,301	11,081	11,000	10,500	11,000	10,697	-2.8
Value Added: $ millions (by Manufacturer)	14,469	18,396	21,040	23,760	24,000	27,237	13.5
Total Employment: 1,000s	239	223	213	212	250	253	1.1
Production Workers: 1,000s	128	110	106	106	110	106	-3.7
Average hourly Wage: $	12.08	11.94	12.19	12.25	13.00	13	1.9
Value Added per Employee: $ thousands	62	66	68	66	68	70	2.3

* Compound Annual Growth Rate

(e) Estimate for 1990 based on CAGR 1985-1989

Source: U.S. Department of Commerce

Table 4

1988 Selected Operating and Financial Ratios for Communications-Related Industries

Item	Office and Computing Machines	Telephone, Telegraph, & Other Communications Services
Total Receipts (in millions of dollars)	96879.6	177156.5
Advertising as a percent of Net Sales	1.1	1.0
Net Profit Before Tax as a percent of Net Sales	#	1.4
Current Ratio (Current Assets to Current Liabilities)	1.7	1.0
Quick Ratio (Liquid Assets to Current Liabilities)	1.0	0.8
Net Sales to Net Working Capital	3.1	66.1
Asset Turnover	0.7	0.4
Total Liabilities to Net Worth	1.4	1.3
Debt Ratio (Total Debt to Total Assets)	58.5	56.2
Return on Assets	12.3	6.0
Return on Equity	14.3	4.3
Retained Earnings to Net Income	29.5	13.6

Note: Data for accounting period 7/87 through 6/88

# Indicates operating deficit

Source: Almanac of Business and Industrial Financial Ratios: 1991 Edition (Prentice Hall)
Note: 1988 is the latest year for which information is available.

Table 5

Various Price Indexes for Certain Telecommunications Equipment, 1985-1990
(percent)

Item	1985	1986	1987	1988	1989	1990
Producer Price Index:						
Telephone and Telegraph Apparatus	100.0	104.0	108.1	108.3	110.2	112.0
Central Office Switches	100.0	101.6	108.3	110.0	109.2	109.8
Private Branch Exchanges (PBX)	100.0	99.7	96.7	96.1	95.1	94.0
Digital Private Branch Exchanges (PBX)	100.0	99.6	96.6	95.7	91.4	89.9
Less than 400 Line PBX's	100.0	99.2	93.7	94.3	95.8	95.2
400 Lines and over PBX's	100.0	100.0	99.5	N/A	N/A	N/A
Telephone Sets	100.0	93.2	90.5	92.3	90.4	91.0
Key Sets	100.0	100.0	97.0	103.2	103.2	106.6
Other Sets	100.0	99.0	84.0	78.2	76.6	N/A
Export Price Index for Telecommunications Equipment	100.0	99.8	101.7	104.2	108.5	112.1
Export Price Index for Telecommunications Equipment	100.0	105.4	111.9	115.5	116.2	113.6

Source: U.S. Department of Commerce

TELECOMMUNICATIONS SERVICES OVERVIEW

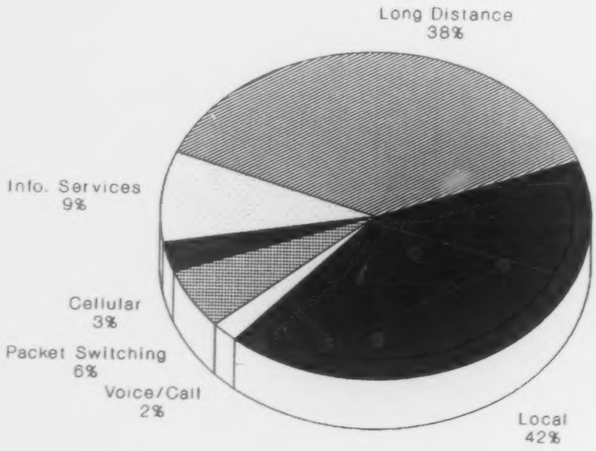
TELECOMMUNICATIONS SERVICES OVERVIEW

The market for telecommunications services encompasses a wide range, from simple "dial tone" to on-line data base access, packet switching, videoconferencing, and private networks. Telecommunications services are provided by local exchange carriers, interexchange carriers, and specialized carriers such as information service providers.

The total market for telecommunications services in 1990 amounted to about $137 billion (Fig. 5). Of that, the local exchange portion (including intraLATA toll) amounted to $58 billion, long distance services amounted to $52 billion, information services such as on-line data bases amounted to $12 billion, special data communication services such as private packet switching amounted to $8 billion, cellular services amounted to $4 billion, and voice messaging/processing and other call processing services amounted to $2 billion. By 1995, the telecommunications services market is expected to reach $175 billion. Much of this growth is likely to occur in the long distance segment (especially 800 and 900 services), as well as the rapidly expanding cellular, voice messaging, and audiotex segments. The market for data communications services will also experience strong growth in the near term but, as ISDN becomes widespread, the demand for data-specific communications services will moderate.

Figure 5

1990 Telecommunications Services Market by Type of Service



Total 1990 Market = $137 Billion

Source: NATA Market Research Department

The U.S. telecommunications network links telephonic and computer equipment for voice, text, data, and video transmission. About 85 percent of traffic on the public network consists of voice telephone communications; data traffic accounts for about 10 percent; and video and other specialized transmission account for the balance of domestic telecommunications. About 550 billion telephone calls were placed over the U.S. public network in 1990, of which almost 85 percent were local. On average, each person makes about 2,200 calls a year, or more than six calls a day. Business customers account for about 20 percent of long-distance domestic telephone use, residential users account for 71 percent, and government and specialized users make up the balance. More than 63 percent of all calls are made during regular business hours. Nearly 94 percent of all households in the United States have telephone service.

Telecommunications service infrastructure investment currently accounts for more than 10 percent of gross fixed capital formation in both the United States and Western Europe. This suggests the tremendous importance the telecommunications network plays in the activities of business and residential consumers.

According to a study conducted by *Networking Management* magazine, which gathered information from some 2,100 companies with over 50 employees, the average telecommunications budget in 1990 amounted to $15.5 million, or eight percent above the 1988 average of $14.4 million. On average, 55 percent of this is budgeted for voice telecommunications and 45 percent for data communications.

In terms of industry breakdown, transportation companies budgeted the most for 1990 — $57.3 million. Federal government agencies budgeted $37.7 million; state and local governments, $32.4 million; companies that provide business services, $17 million; retail establishments, $14.3 million; and insurance companies, $11.2 million. Other industries surveyed include manufacturing, education, health care, and agriculture/mining/construction.

On average, 33 percent of telecom budgets was spent on line charges, 20 percent on salaries, 15 percent on equipment, 11 percent on lease payments, 9 percent on maintenance, and the balance on training, overhead, and other miscellaneous costs. In terms of the product/service offerings large business users will be expanding, 86 percent anticipate a significant increase in digital private lines, 85 percent expect to increase their expenditures on data communications networks, and 76 percent will increase long distance usage. Other areas of expansion include increased expenditures for fax equipment, cellular, voice messaging, and PBXs.

According to an International Communications Association study of companies that spend at least $1 million per year on telecommunications, on average large business telecommunications users spent 0.6 percent of their annual revenues on telecommunications, representing 0.9 percent of their total operating expenses.

The composite Consumer Price Index (CPI) for all telephone service increased 1.0 percent from 1989 to 1990 (Table 6, page 31). The CPI for local service increased 3.8 percent during the same period, while intrastate toll service rates dropped 2.0 percent and interstate toll rates dropped 5.5 percent. Overall, since 1983, local rates have increased 48.5 percent, intrastate toll rates have increased 0.1 percent, and interstate toll rates have dropped 39.3 percent. During the same time, the CPI for all items increased 31.4 percent. The overall price level for telephone service should be stable for the near term as long distance rates drop slightly, offsetting possible small increases in local rates.

Since much of the telecommunications services industry is regulated, it has traditionally been guaranteed a certain rate of return. However, this is changing as certain segments of the telecommunications services market become more competitive. (Local exchange carriers are, for the most part, still guaranteed a certain rate of return.) Comparing 1988 with 1987 industry operating and financial ratios (the latest years for which such information is available), it appears the health of the industry has been generally sluggish. In 1988, the cost of operations as a share of net sales amounted to 34.9 percent, up from 33.8 percent from 1987. However, net profit as a percent of net sales rose from 1.1 percent in 1987 to 1.4 percent in 1988. Return on equity rose from 2.9 percent to 4.3 percent (Table 4, page 18).

Technological convergence has reduced the structural differences between the data processing and telecommunications industries, leading to overlapping markets and customers. The technical interaction of computing and telephony can be characterized by the functional allocation of processing "intelligence" within the enterprise-wide telecommunications network. In the new generation of telephone technology, remotely distributed digital processors are programmed to function independently of central office switches, without the centralized signaling instructions that have defined traditional network architecture. In addition, the network provides interconnection for CPE ranging from computer terminals with data processing capabilities to facsimile terminals, voice messaging systems, integrated voice-data work stations, and PBXs.

One of the key market developments in the past two years has been the emergence of technical standards for ISDN network switches. During 1990, there were still at most 200 ISDN customers trialing ISDN (Fig. 6, page 24-29). The new standards, dubbed ISDN 1, are directed primarily at the standardization of interfaces and services of a public digital network providing an end-to-end digital pipeline for the transmission of voice, data, video, image, and text. With firm network standards, the LECs are anticipating rapid deployment and tariffing of ISDN, centrex, trunks, and business lines. In addition to the wide variety of services a user will be will be able to access, ISDN will provide users with direct control over their services. For instance, users will be able to initiate and terminate services of their choice from their own terminals.

While many of the network standards have now been established, status of standards for terminal equipment remains unclear. Until terminal equipment standards are firm, analysts minimize prospects for ISDN's becoming a major economic and technological force driving competition in the telecommunications industry.

Others assert that the residential customer does not want or need anything more than "plain old telephone service" (POTS), but nonetheless will be required to foot the bill for the development of ISDN, which will benefit primarily large business customers. Furthermore, critics argue the full benefits of ISDN will not be realized until every potential household and business has subscribed, and that may never happen.

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
AMERITECH	Illinois Bell	McDonalds Corp.	Oak Brook, IL	8/88	AT&T 5ESS	BRI*	CS*	2,696
	Illinois Bell	Progressive Computing	Oak Brook, IL	10/88	AT&T 5ESS	BRI	CS	10
	Illinois Bell	AT&T Bell Labs	Naperville, IL	4/89	AT&T 5ESS	BRI	CS	10,500
	Illinois Bell	Internal	NA*	4Q88	AT&T 5ESS	BRI	CS	250
	Illinois Bell	NA	NA	4Q88	AT&T 5ESS	BRI	CS	170
	Illinois Bell	NA	NA	4Q88	AT&T 5ESS	BRI	CS	400
	Illinois Bell	Motorola	Schaumburg, IL	4Q88	5ESS & DMS100	BRI	CS	50
	Illinois Bell	Northern Telecom	Schaumburg, IL	4Q89	NT DMS-100	BRI	CS	NA
	Illinois Bell	Internal	NA	4Q88	NT DMS-100	BRI	CS	60
	Illinois Bell	NA	NA	4Q88	AT&T 5ESS	BRI	CS	50
	Illinois Bell	NA	Chicago, IL	3Q89	AT&T 5ESS	BRI	CS	46
	Illinois Bell	City of Naperville	Naperville, IL	3Q89	AT&T 5ESS	BRI	CS	64
	Illinois Bell	Mitel	Oak Brook, IL	5/90	AT&T 5ESS	BRI	CS	2
	Illinois Bell	AT&T	Oak Brook, IL	12/90	AT&T 5ESS	BRI	CS	75
	Illinois Bell	Chicago Bridge & Iron	Oak Brook, IL	9/88	AT&T 5ESS	BRI	CS	3
	Illinois Bell	Teleos	Rolling Meadows, IL	1Q90	AT&T 5ESS	BRI	CS	2
	Illinois Bell	AT&T	Rolling Meadows, IL	11/90	AT&T 5ESS	BRI	CS	290
	Illinois Bell	AT&T	Chicago, IL	3/90	AT&T 5ESS	BRI	CS	70
	Illinois Bell	S&H Motivation	Hillside, IL	5/89	AT&T 5ESS	BRI	CS	180
	Illinois Bell	Northern Trust	Chicago, IL	2Q90	AT&T 5ESS	BRI	CS	2,000
	Illinois Bell	Chicago Title and Trust	Chicago, IL	4/90	AT&T 5ESS	BRI	TR	50
	Illinois Bell	Michael Reese Hospital	Chicago, IL	3/90	AT&T 5ESS	BRI	CS	31
	Illinois Bell	1st Chicago Futures	Chicago, IL	9/89	AT&T 5ESS	BRI	CS	45
	Illinois Bell	1st National Bank	Chicago, IL	5/90	AT&T 5ESS	BRI	CS	1
	Illinois Bell	Cook County Hospital	Chicago, IL	12/90	AT&T 5ESS	BRI	CS	1
	Indiana Bell	Indiana University	Bloomington, IN	6/89	NT DMS-100	BRI	CS	50/1400
	Indiana Bell	Internal	South Bend, IN	1Q89	AT&T 5ESS	BRI	CS	47
	Indiana Bell	Citimark Development Corp	Fishers, IN	1Q89	AT&T 5ESS	BRI	CS	52
	Michigan Bell	Internal	Ann Arbor, MI	1Q89	AT&T 5ESS	BRI	CS	20
	Michigan Bell	Allied Signal	Southfield, MI	2Q89	NTDMS-100	BRI	TR	2
	Michigan Bell	University of Michigan	Ann Arbor, MI	3Q89	AT&T 5ESS	BRI	CS	12
	Michigan Bell	Michigan State Univ.	East Lansing, MI	1Q90	NT DMS-100	BRI	CS	4
	Michigan Bell	Flint Community Schools	Flint, MI	4Q90	AT&T 5ESS	BRI	CS	125
	Ohio Bell	Internal	Cleveland, OH	4Q88	AT&T 5ESS	BRI	CS	35

*CO- Central Office, CS- Commercial Service, TR-Trial, BRI- Basic Rate Interface, PRI-Primary Rate Interface

Fig. 6 Source: Reprinted from *ISDN News*, January 1991, with permission from Phillips Publishing, Potomac, MD

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
	Ohio Bell	NA	Cleveland, OH	4Q88	AT&T 5ESS	BRI	CS	25
	Ohio Bell	NA	Columbus, OH	2Q89	AT&T 5ESS	BRI	CS	855
	Ohio Bell	NA	Columbus, OH	3Q89	AT&T 5ESS	BRI	CS	100
	Ohio Bell	NA	Columbus, OH	4Q89	AT&T 5ESS	BRI	CS	80
	Wisconsin Bell	Lawrence University	Appleton, WI	6/89	AT&T 5ESS	BRI	CS	47
	Wisconsin Bell	AT&T Sales	Milwaukee, WI	1/89	AT&T 5ESS	BRI	CS	17
	Wisconsin Bell	Amity Leather	West Bend, WI	11/89	AT&T 5ESS	BRI	CS	15
	Wisconsin Bell	State of Wisconsin	Madison, WI	2/90	AT&T 5ESS	BRI	TR	2
	Wisconsin Bell	Appleton Area Schools	Appleton, WI	4/90	AT&T 5ESS	BRI	CS	15
	Wisconsin Bell	NA	NA	4Q89	NT DMS-100	BRI	TR	26
BELL ATLANTIC	New Jersey Bell	Bellcore Research	Navesink, NJ	1/88	Siemens EWSD	BRI	CS	136
	New Jersey Bell	AT&T Bell	3 NJ Locations	2nd half 1990	AT&T 5ESS	BRI	CS	NA
	New Jersey Bell	NA	NA	NA	AT&T 5ESS	BRI	CS	NA
	New Jersey Bell	AT&T Consumer Products	Holmdel, NJ	12/88	AT&T 5ESS	BRI	CS	63
	New Jersey Bell	TELEOS	Holmdel, NJ	5/89	AT&T 5ESS	BRI	CS	15
	New Jersey Bell	AT&T	Newark, NJ	1990	AT&T 5ESS	BRI	CS	NA
	New Jersey Bell	Westinghouse	Morristown, NJ	11/89	AT&T 5ESS	BRI	CS	4
	C&P	Commonwealth of VA	Richmond, VA	4/88	AT&T 5ESS	BRI	CS	800
	C&P	John Hopkins Medical Inst.	Baltimore, MD	7/88-7/89	AT&T 5ESS	BRI	CS	NA
	C&P	W. Virginia University	Morgantown, WV	6/88	AT&T 5ESS	BRI	CS	85/660
	C&P	3 internal	Colesville, MD	2Q89	AT&T 5ESS	BRI	Internal	760
	C&P	Fannie Mae	Washington, DC	6/88	AT&T 5ESS	BRI	CS	NA
	C&P	GSA/WITS	Washington, DC	2Q90	AT&T 5ESS	BRI	CS	1,000
	C&P	NA	Virginia	NA	AT&T 5ESS	BRI	CS	NA
	C&P	15 X NA	NA	NA	AT&T 5ESS	BRI	CS	NA
	C&P	Internal	NA	7/88	NT DMS-100	BRI	CS	14
	C&P	Catholic University	Washington, DC	NA	AT&T 5ESS	BRI	NA	11
	Bell of Penn.	NA	Harrisburg, PA	7/88	NT DMS-100	BRI	TR	50
	Bell of Penn.	NA	Philadelphia, PA	6/89	AT&T 5ESS	BRI	CS	6
	Bell of Penn.	NA	Philadelphia, PA	6/89	AT&T 5ESS	BRI	CS	200
	Bell of Penn.	Carnegie Mellon Univ.	Pittsburgh, PA	8/88	AT&T 5ESS	BRI	TR	3
	Bell of Penn.	Westinghouse	Pittsburgh, PA	4Q88	AT&T 5ESS	BRI	TR	NA
	Bell of Penn.	Mellon Bank	Pittsburgh, PA	11/88	AT&T 5ESS	BRI	TR	NA

Fig. 6 Source: Reprinted from *ISDN News*, January 1991, with permission from Phillips Publishing, Potomac, MD

*CO- Central Office, CS- Commercial Service, TR-Trial, BRI- Basic Rate Interface, PRI-Primary Rate Interface

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
	Bell of Penn.	2 X NA	Philadelphia, PA	12/89	AT&T 5ESS	BRI	CS	NA
	Bell of Penn.	2 X NA	NA	NA	AT&T 5ESS	BRI	CS	NA
BELLSOUTH	Southern Bell	AT&T Network Systems	Atlanta, GA	3/88	AT&T 5ESS	BRI	LCS*	600
	Southern Bell	Contel	Atlanta, GA	3/88	AT&T 5ESS	BRI	LCS	53
	Southern Bell	Digital Equipment Corp.	Atlanta, GA	3/88	AT&T 5ESS	BRI	LCS	10
	Southern Bell	Internal	Atlanta, GA	6/87	AT&T 5ESS	BRI	Test	NA
	Southern Bell	Internal	Atlanta, GA	5/88	NT DMS-100	BRI	Test	NA
	Southern Bell	Internal	Boca Raton, FL	11/87	Siemens EWSD	BRI	Test	NA
	Southern Bell	Heathrow	Lake Mary, FL	11/88	NT DMS-100	BRI	Test	17
	Southern Bell	Digital Communications Assoc.	Atlanta, GA	1/89	AT&T 5ESS	BRI	LCS	2
	Southern Bell	NEC	Atlanta, GA	1/89	AT&T 5ESS	BRI	LCS	15
	Southern Bell	University of Florida	Gainsville, FL	4Q89	NT DMS-100	BRI	LCS	4
	Southern Bell	General Services Admin.	Atlanta, GA	11/89	NT DMS-100	BRI	NA	6
	South Central Bell	Internal w/ Bell South Svcs.	Birmingham, AL	2Q89	AT&T 5ESS	BRI	Test	325
	South Central Bell	U.S. Army Redstone Arsenal	Huntsville, AL	6/89	AT&T 5ESS	BRI	LCS	NA
	South Central Bell	Federal Express	Memphis, TN	5/90	NT DMS-100	PRI	TR	NA
	South Central Bell	Univ. of Tenn. Medical Ctr.	Memphis, TN	6/90	5ESS/DMS-100	BRI	TR	NA
	South Central Bell	Golden Triangle Reg. Med Ctr.	Columbus, MS	8/90	AT&T 5ESS	BRI	LCS	NA
	South Central Bell	Intergraph	Huntsville, AL	6/90	AT&T 5ESS	BRI	LCS	NA
NYNEX	New York Tel.	Eastman Kodak	New York, NY	1Q91	AT&T 5ESS	BRI	TR	20
	New York Tel.	Manufacturers Hannover	New York, NY	4Q90	AT&T 5ESS	BRI	TR	20
	New York Tel.	Young & Rubican	New York, NY	1Q91	AT&T 5ESS	BRI	TR	10
	New York Tel.	Shearson Lehman, Hutton	New York, NY	1Q91	5ESS/DMS-100	BRI/PRI	TR	20
	New York Tel.	Shearson Lehman, Hutton	New York, NY	1Q89	5ESS/DMS-100	BRI	LCS	5
	NY&New England Ltd.	Internal	New York, NY	1Q89	AT&T 5ESS	BRI/PRI	Interworking Test	
	New England Tel.	AT&T Facilities	Merrimack Val.	4Q88	AT&T 5ESS	BRI	LCS	1,000
	New England Tel.	Internal	Portland, ME	1Q91	AT&T 5ESS	PRI	Test	NA
	New England Tel.	Microcom	Boston, MA	1Q89	AT&T 5ESS	BRI	CS	100
	New England Tel.	Commerce Insurance Group	Webster, MA	2Q89	AT&T 5ESS	BRI	TR	50
	New England Tel.	State of New Hampshire	Concord, NH	2Q89	AT&T 5ESS	BRI	TR	6
	New England Tel.	Harvard University	Cambridge, MA	4Q89	AT&T 5ESS	BRI	CS	3,400
	New England Tel.	NYNEX Info. Resources	Middletown, MA	1Q90	AT&T 5ESS	BRI	CS	480

Fig. 6 Source: Reprinted from *ISDN News*, January 1991, with permission from Phillips Publishing, Potomac, MD

*CO- Central Office, CS- Commercial Service, TR-Trial, BRI- Basic Rate Interface, PRI-Primary Rate Interface

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
	New England Tel.	Amherst College	Amherst, MA	2Q90	AT&T 5ESS	BRI	TR	25
PACIFIC TEL	Pacific Bell	City of Fresno	Fresno, CA	4/89	AT&T 5ESS	BRI	CS	730
	Pacific Bell	AT&T Network Systems	Sunnyvale, CA	4/90	AT&T 5ESS	BRI	CS	1,100
	Pacific Bell	Aerospace	El Segundo, CA	11/89	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Xerox	Palo Alto, CA	12/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Tekelec	Los Angeles, CA	7/90	AT&T 5ESS	BRI	CS	8
	Pacific Bell	Northern Telecom	San Ramon, CA	4/90	NT DMS-100	BRI	CS	NA
	Pacific Bell	Apple Computer	Sunnyvale, CA	5/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Hayes Microcomputer	Sunnyvale, CA	5/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Jet Propulsion Laboratories	La Canada, CA	12/90	AT&T 5ESS	BRI	CS	30/1000
	Pacific Bell	Ricoh	San Jose, CA	8/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	Compression Labs, Inc.	Sunnyvale, CA	8/90	AT&T 5ESS	BRI	CS	NA
	Pacific Bell	First Interstate Bank	Fresno, CA	12/90	AT&T 5ESS	BRI	CS	NA
SOUTHWESTERN BELL	Southwestern Bell	AT&T Technologies	Oklahoma City, OK	7/88	AT&T 5ESS	BRI	CS	302/1,000
	Southwestern Bell	Tenneco	Houston, TX	6/88	AT&T 5ESS	BRI	CS	2,515/3,900
	Southwestern Bell	3M Corporation	Austin, TX	7/88	AT&T 5ESS	BRI	CS	2,337/3,165
	Southwestern Bell	Shell Oil	Houston, TX	9/88	AT&T 5ESS	BRI	CS	3,775/6,650
	Southwestern Bell	AT&T Network Systems	St. Louis, MO	11/88	AT&T 5ESS	BRI	CS	1,700/2,300
	Southwestern Bell	Rockwell International	Dallas, TX	12/88	AT&T 5ESS	BRI	CS	1,155/1,200
	Southwestern Bell	Hermann Hospital	Houston, TX	1/89	AT&T 5ESS	BRI	CS	153/260
	Southwestern Bell	Methodist Hospital	Houston, TX	1/89	AT&T 5ESS	BRI	CS	180/700
	Southwestern Bell	Univ. of Texas/Houston	Houston, TX	11/89	AT&T 5ESS	BRI	CS	89/485
	Southwestern Bell	Valero	San Antonio, TX	12/89	AT&T 5ESS	BRI	CS	271/271
	Southwestern Bell	IBM	Austin, TX	2/90	AT&T 5ESS	BRI	CS	24/200
	Southwestern Bell	Mitchell Energy	Houston, TX	3/90	AT&T 5ESS	BRI	CS	477/679
	Southwestern Bell	Datapoint	San Antonio, TX	3/90	AT&T 5ESS	BRI	CS	6/350
	Southwestern Bell	Shell (Deer Park)	Houston, TX	3/90	AT&T 5ESS	BRI	CS	917/993
	Southwestern Bell	Kerr McGee Corp	Oklahoma City, OH	5/90	NT DMS-100	BRI	CS	NA/400
	Southwestern Bell	SWB Technology Resources	St. Louis, MO	1990	AT&T 5ESS	PRI	Internal	1
	Southwestern Bell	SWBT Advanced Technology Lab	St. Louis, MO	4/88	AT&T 5ESS	BRI/PRI	Internal	50
	Southwestern Bell	SWBT Advanced Technology Lab	St. Louis, MO	4/88	NT DMS-100	BRI/PRI	Internal	50
	Southwestern Bell	SWBT Advanced Technology Lab	St. Louis, MO	4/88	Siemens EWSD	BRI/PRI	Internal	50

*CO- Central Office, CS- Commercial Service, TR-Trial, BRI- Basic Rate Interface, PRI-Primary Rate Interface

Fig. 6 Source: Reprinted from *ISDN News*, January 1991, with permission from Phillips Publishing, Potomac, MD

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
	Southwestern Bell	AT&T Network Systems	Dallas, TX	4/90	AT&T 5ESS	BRI	CS	30
	Southwestern Bell	Systematics	Little Rock, AR	8/90	AT&T 5ESS	BRI	CS	200
	Southwestern Bell	Zocom Technologies	Dallas, TX	7/90	AT&T 5ESS	BRI	CS	200
	Southwestern Bell	AT&T Microelectronics	Dallas, TX	5/90	AT&T 5ESS	BRI	CS	225
	Southwestern Bell	Vadis	Dallas, TX	1/90	AT&T 5ESS	BRI	CS	260
	Southwestern Bell	Interclaim	Dallas, TX	1/90	AT&T 5ESS	BRI	CS	159
	Southwestern Bell	Johnson County Community Coll.	Overland Park, KS	1990	AT&T 5ESS	BRI	CS	20
	Southwestern Bell	NCNB	San Antonio	1990	AT&T 5ESS	BRI	CS	12
	Southwestern Bell	AT&T Network Systems	Oklahoma City, OK	1990	NT DMS-100	BRI	CS	11
	Southwestern Bell	City of Dallas	Dallas, TX	1991	AT&T 5ESS	BRI	CS	0/200
	Southwestern Bell	Tulsa Laureate Hospital	Tulsa, OK	1990	AT&T 5ESS	BRI	CS	2
	Southwestern Bell	AT&T Network Systems	Overland Park	1991	AT&T 5ESS	BRI	CS	30
	Southwestern Bell	US Sprint	Kansas City, MO	1991	AT&T 5ESS	PRI	CS	18
US WEST	US West Comm.	Boeing Co.	Seattle, WA		AT&T 5ESS	BRI	CS	860
	US West Comm.	Boulder Valley	Boulder, CO		AT&T 5ESS	BRI	Pending	26
	US West Comm.	City of Colorado Springs	Colorado Spgs. CO		AT&T 5ESS	BRI	Pending	
	US West Comm.	City of Denver	Denver, CO		AT&T 5ESS	BRI	Pending	400
	US West Comm.	Inter-Tel Corp.	Chandler, AZ		AT&T 5ESS	BRI	Pending	
	US West Comm.	Intermountain Health Care	Salt Lake City, UT		NT DMS-100	BRI	CS	6
	US West Comm.	Microwave Inc	Des Moines, IA		AT&T 5ESS	BRI	CS	3
	US West Comm.	Mullen Telecommunications	Denver, CO		AT&T 5ESS	BRI	CS	2
	US West Comm.	State of Nebraska	Omaha, NE		AT&T 5ESS	BRI	Pending	20
	US West Comm.	Rocky Flats Weapons Plant	Broomfield, CO		AT&T Definity	PRI	CS	8
	US West Comm.	Star Tribune	Minneapolis, MN	11/89	AT&T Definity	PRI	CS	9
	US West Comm.	U.S. Bank Corp.	Portland, OR	*	NT DMS-100	BRI	CS	40
	US West Comm.	Vectra Banking Corporation	Seattle, WA		AT&T 5ESS	BRI	CS	68
	US West Comm.	AT&T Network Systems	Denver, CO	9/88	AT&T 5ESS	BRI/PRI	CS	
	US West Comm.	AT&T Omaha Works	Omaha, NE	6/89	AT&T 5ESS	BRI	CS	
	US West Comm.	3M Corporation	St. Paul, MN	8/88	AT&T 5ESS	BRI	CS	
	US West Comm.	ACB Companies	Phoenix, AZ	9/89	NT DMS-100	BRI	CS	
	US West Comm.	AT&T Communications	Seattle, WA	5/90	AT&T 5ESS	BRI/PRI	CS	
	US West Comm..	Greyhound/Dial Corp.	Phoenix, AZ		AT&T 5ESS	PRI	CS	

Fig. 6 Source: Reprinted from *ISDN News*, January 1991, with permission from Phillips Publishing, Potomac, MD

*CO- Central Office, CS- Commercial Service, TR-Trial, BRI- Basic Rate Interface, PRI-Primary Rate Interface

ISDN NEWS' RBOC ISDN TRIALS AND COMMERCIAL OFFERINGS

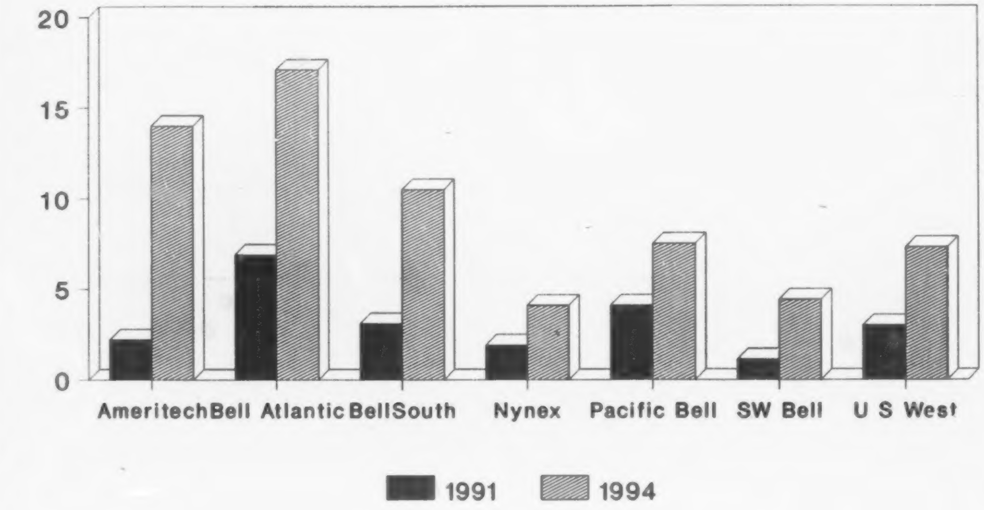
	OPERATING UNIT	COMPANY	LOCATION	START	CO*SWITCH	TYPE	STATUS	#LINES
US WEST	US West Comm.	AT&T Network Systems	Phoenix, AZ		AT&T 5ESS	BRI	CS	
	US West Comm.	Fujitsu Switching Systmes of Am.	Phoeniz, AZ		AT&T 5ESS	BRI	CS	
	US West Comm.	Phoenix Cardinals	Tempe, AZ		N.T. DMS-100	PRI	CS	
	US West Comm.	AT&T Netowrk Systems	Mineapolis, MN		AT&T 5ESS	BRI	CS	
	US West Comm.	US West Advanced Technologies	Boulder, CO		AT&T 5ESS	BRI	CS	
	US West Comm.	NEC	Denver, CO		AT&T 5ESS	BRI	CS	
	US West Comm.	US West Communications	Denver, CO		AT&T 5ESS	BRI	CS	
	US West Comm.	US West Direct	Denver, CO		AT&T 5ESS	BRI	CS	
	US West Comm.	US West Direct	Phoenix, AZ		AT&T 5ESS	BRI	CS	

*CO- Central Office, CS- Commercial Service, TR-Trial, BRI- Basic Rate Interface, PRI-Primary Rate Interface

Fig. 6 Source: Reprinted from *ISDN News*, January 1991, with permission from Phillips Publishing, Potomac, MD

Figure 7

RBOC Lines with ISDN Access, 1991 vs. 1994



Source: RBOC estimates

Table 6

Annual Rate of Change in Major Price Indexes for Telecommunications Services, 1978-1990

YEAR	GNP FIXED WEIGHT PRICE INDEX	CONSUMER PRICE INDEX (CPI)					PRODUCER PRICE INDEX (PPI)		
		ALL ITEMS	ALL TELEPHONE SERVICES	LOCAL SERVICES	INTERSTATE TOLL SERVICE	INTRASTATE TOLL SERVICE	LOCAL RESIDENTIAL SERVICES	LOCAL BUSINESS SERVICES	TOLL SERVICE
1978	7.2%	9.0%	0.9%	1.4%	-0.8%	1.3%	3.1%	4.4%	-0.3%
1979	8.8	13.3	0.7	1.7	-0.7	0.1	1.6	2.2	-0.5
1980	9.8	12.5	4.6	7.0	3.4	-0.6	7.1	5.8	4.1
1981	8.5	8.9	11.7	12.6	14.6	6.2	15.6	15.7	10.8
1982	5.0	3.8	7.2	10.8	2.6	4.2	9.0	5.8	3.8
1983	3.9	3.8	3.6	3.1	1.5	7.4	0.2	2.2	1.6
1984	3.7	3.9	9.2	17.2	-4.3	3.6	10.4	24.1	-1.6
1985	3.6	3.8	4.7	8.9	-3.7	0.6	12.4	5.6	-0.8
1986	2.3	1.1	2.7	7.1	-9.4	0.3	8.9	2.5	-7.0
1987	3.8	4.4	-1.3	3.3	-12.4	-3.0	2.6	-0.8	-7.9
1988	4.6	4.4	1.3	4.5	-4.2	-4.2	4.6	0.5	-2.3
1989	4.0	4.6	-0.3	0.6	-1.3	-2.6	1.9	0.6	-0.1
1990*	5.3	5.4	1.0	3.8	-5.5	-2.0	0.3	-0.1	-1.5

NOTE -- THE GROSS NATIONAL PRODUCT (GNP) FIXED WEIGHT PRICE INDEX REFLECTS INFLATION THROUGHOUT THE ECONOMY, AND THE CPI FOR ALL ITEMS MEASURES THE IMPACT OF INFLATION ON CONSUMERS. THE CPI INDEX OF ALL TELEPHONE SERVICES IS BASED ON A "MARKET BASKET" INTENDED TO REPRESENT THE TELEPHONE RELATED EXPENDITURES OF A TYPICAL URBAN HOUSEHOLD. IT INCLUDES BOTH LOCAL AND LONG DISTANCE SERVICES. THE CPI INDEX OF LOCAL TELEPHONE CHARGES IS BASED ON MONTHLY SERVICE CHARGES, MESSAGE UNIT CHARGES, LEASED EQUIPMENT, INSTALLATION, ENHANCED SERVICES (SUCH AS TONE DIALING AND CALL WAITING), TAXES, SUBSCRIBER LINE CHARGES, AND ALL OTHER CONSUMER EXPENDITURES ASSOCIATED WITH TELEPHONE SERVICES EXCEPT LONG DISTANCE CHARGES. IN CONTRAST, THE PPI INDEX OF LOCAL RESIDENTIAL SERVICES IS BASED ONLY ON SERVICE CHARGES FOR RESIDENTIAL SERVICE, OPTIONAL TOUCH-TONE SERVICE, AND SUBSCRIBER LINE CHARGES.

* ANNUAL RATE OF CHANGE FROM DECEMBER 1989 THROUGH JUNE 1990 FOR GNP FIXED WEIGHT, THROUGH AUGUST 1990 FOR CONSUMER PRICE INDEX, AND THROUGH SEPTEMBER 1990 FOR PRODUCER PRICE INDEX.

Source: Federal Communications Commission

LOCAL EXCHANGE MARKET

LOCAL EXCHANGE MARKET

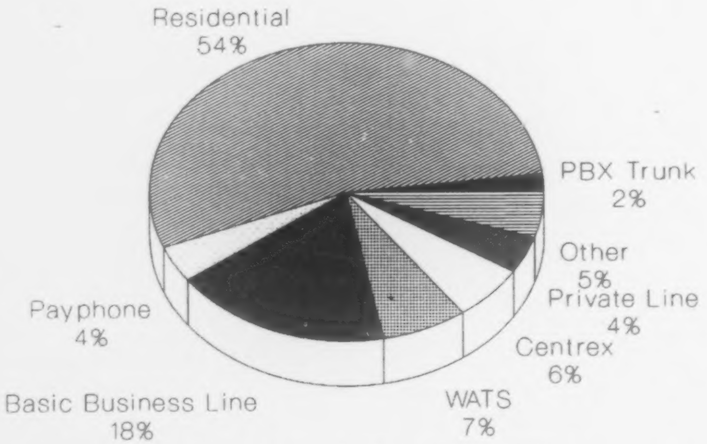
Overview

The telecommunications local exchange marketplace is comprised of the services provided by local exchange companies (LECs). LECs are monopoly service providers within franchised areas, which operate in an environment governed by both state and national regulations. Companies that once comprised the Bell Telephone System may provide services only within, not between, specific operating regions called Local Access and Transport Areas (LATAs). Each Bell Operating Company (BOC) is permitted to and does operate within more than one LATA.

LECs include regional BOCs (*e.g.* Bell Atlantic), BOC-owned telcos (*e.g.*, C&P), and independent telcos (*e.g.*, GTE). Within each area, a telephone company provides a variety of services. These services can generally be divided into two basic categories — exchange services and exchange access services. Exchange services are the telecommunications services provided within the serving area, while exchange access services connect customers to long distance carriers. The services themselves range from simple dial tone to specialized customer services and system features such as hunt groups, call waiting, call forwarding, and centrex. In addition, in 1988, BOCs were given permission under specific conditions to provide voice messaging services and

Figure 8

1990 Local Exchange Services Market by Type of Service



1990 Total Market = $58 Billion

Source: NATA Market Research Department

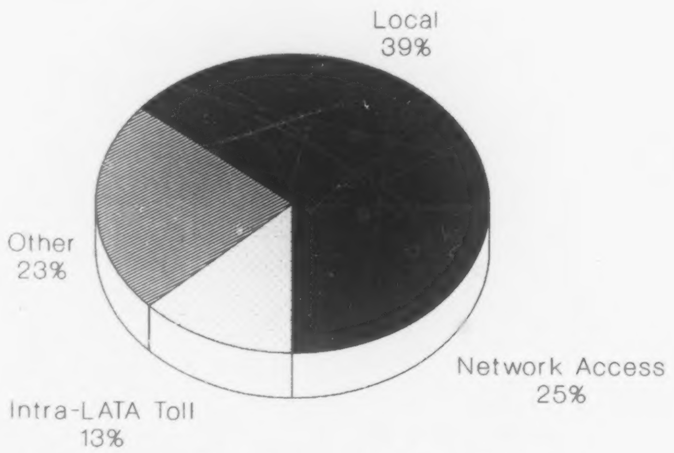
gateways for certain other enhanced services.

In 1990, the total nationwide local exchange market (including intraLATA toll) amounted to some $58 billion (Fig. 8, page 35). This can be divided into two general segments — residential and business markets. For all carriers combined, the residential market represents the largest portion, accounting for 54 percent of the total. (See Table 7, page 44, for the relative size of the business and residential portions for the top 30 cities.) For the most part, the residential portion of the market is basic dial tone service. Some LECs offer certain advanced residential services, but these are new, and household penetration is very low. These services, such as call forwarding, call waiting, voice messaging, etc., are likely to grow in popularity and provide the impetus for growth in the residential services segment.

In 1990, the business telecommunications services segment of the market amounted to $27 billion. At $10.4 billion, the largest portion of the business services market is basic business lines used principally by small businesses in conjunction with a key system or single-line instruments. Other significant portions of the business telecommunications services segment include revenue from WATS (wide area telecommunications service) at $4 billion, centrex at $3.5 billion, payphone service and private line service, each at $2.3 billion, and PBX trunk revenue at $.6 billion. The balance is accounted for by a variety of services, including certain digital, voice processing, and gateway services, which provide much of the momentum for near-term growth in the business segment of the telecommunications services market.

Figure 9

1990 RBOC Revenue by Source



1990 Total Revenue = $79.7 Billion

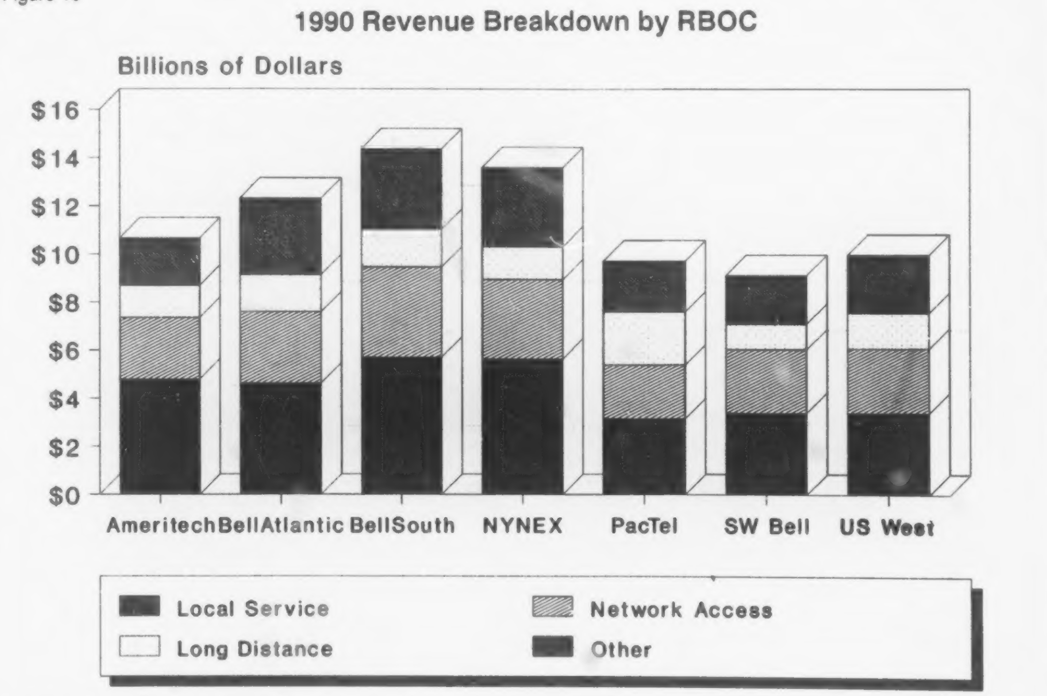
Source: Company Annual Reports

Regulated Local Exchange Carriers

There are hundreds of companies across the United States offering local telephone service. In general, they can be grouped into two categories — the LECs that were divested from AT&T in 1984, commonly called the Bell Operating Companies (BOCs), and the independent telephone companies such as GTE, Centel, and Contel. There are 22 BOCs grouped into seven regional holding companies, commonly called RBOCs, and hundreds of independent telephone companies. (See Table 8, pages 45-47, for a listing of the top 150 LECs.) The RBOCs control an estimated 80 percent or more of the local exchange business. One of the most significant developments of 1990 was the announced acquisition of Contel by GTE. This transaction will create the largest local exchange company in the United States by virtually every measure and represents the most significant milestone in a trend in the telephone industry toward increased consolidation through acquisition and merger.

The seven RBOCs are Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis (commonly called PacTel), Southwestern Bell, and U S West. In 1990, total revenue for all RBOCs amounted to $79.7 billion, up from $77.1 billion reported in 1989 (Table 9, page 48, Fig. 9, page 36, and Fig. 10). At $30.7 billion, the largest source of revenue was local service, followed by the $20.1 billion paid by long distance carriers for access to the local network. BellSouth and NYNEX earned the most revenue, more than $13 billion each. In addition, the RBOCs continue to be profitable: the range of net income as a percent of

Figure 10



Source: Company Annual Reports

revenue for 1989 varied from a low of 7 percent for NYNEX to a high of 12 percent for Southwestern Bell and U S West (Fig. 11).

In terms of total revenue in 1989, the largest independent telephone companies were GTE ($17.4 billion), United Telecommunications ($7.5 billion), Contel ($3.1 billion), and Centel ($1.2 billion). Total estimated 1989 revenue for all independent telephone companies amounted to $39.5 billion (Table 10, page 49). Of the top four, profitability varied greatly from a high of 37 percent of revenue for Centel to a low of 4.8 percent for United. Virtually all the fluctuation in profitability is related to revenue and expenses from nonlocal exchange business.

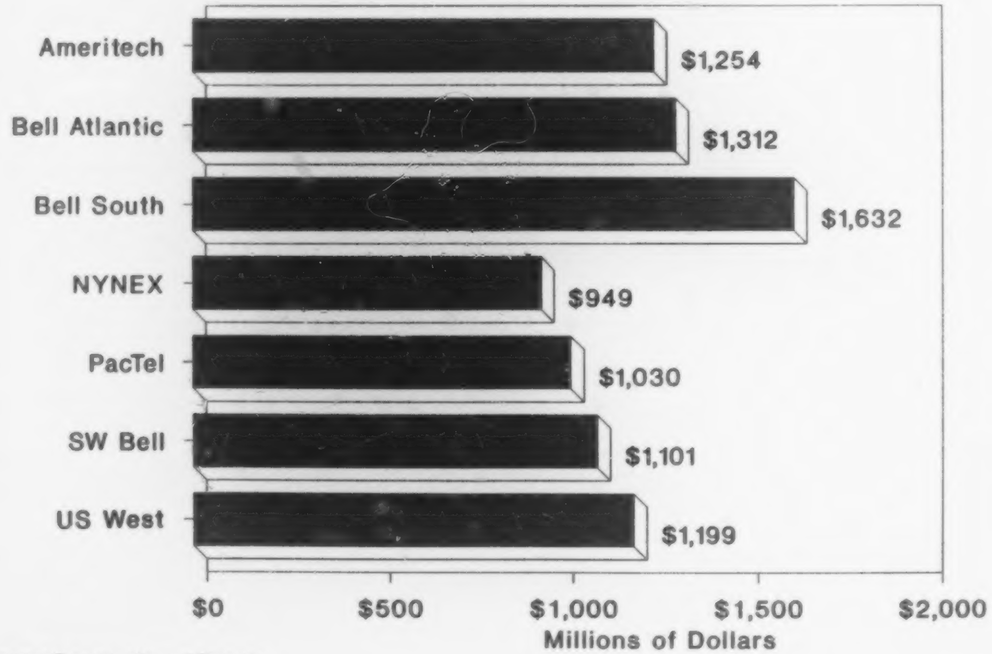
Despite the continued and relatively stable profitability of local telephone service, there are some emerging areas that could affect sustained high levels of future profit. Issues such as bypass, CPE distribution, ISDN, service pricing deregulation and regulation, enhanced services, constraints resulting from the Consent Decree of the AT&T divestiture, sales agency, and international opportunities provide the RBOCs and independents with a very complex environment. As the companies meet these challenges and opportunities, they will undoubtedly derive more of their revenue from sources other than local telephone service. In fact, some estimates project that by 1995 only 65 percent of RBOC revenues will be derived from local exchange business.

Bypass

One of the issues critical to regulated LECs is bypass. Businesses are beginning to bypass the services provided by the local

Figure 11

1990 Net Income by RBOC Revenue



Source: Company Annual Reports

operating company. Bypass is usually considered to be of two types — facility bypass and switched services bypass.

Facility bypass occurs when a customer elects to bypass some or all of the local telco's facilities with its own network. The customer may either tie into the network somewhere along the line, usually at the long-distance carrier's point of presence, or bypasses the network on an end-to-end basis. Local telcos usually divide facility bypass into switched facility bypass and private line bypass. Telcos estimate the total 1990 loss from facility bypass at almost $2.0 billion.

Switched services bypass occurs when a customer uses a higher-capacity, telco-provided service or telco-leased private lines to bypass lower-capacity, higher-priced services. The total 1990 estimated loss to the telcos from switched service bypass amounted to $2.5 billion.

CPE Distribution

The RBOCs have collectively achieved sales of some $1.9 billion, or about 10 percent of the entire CPE marketplace (including all voice and data CPE). These sales have been achieved through in-house joint services/CPE marketing organizations and through acquisition of independent distribution organizations, *i.e.*, interconnects. While the RBOCs have had some success with CPE sales across the country, their successes have been spotty even in their own regions. In 1990, U S West gave up its CPE distribution business to small business customers within its own territory. The RBOCs have been even less successful outside their own franchise areas. In fact, Ameritech recently sold its entire non-Ameritech-territory embedded base of equipment. It seems clear the RBOCs will continue to sell some CPE, but it is not clear they will be any more financially successful at it than other CPE vendors, especially outside their own regions, where they have no installed customer base. Further discussion of RBOC CPE activities is included in the section on CPE.

ISDN

As mentioned in the overview to the section on telecommunications services, ISDN is undergoing a number of trials throughout the country. For the RBOCs, ISDN penetration is gaining momentum. In 1991, the total number of ISDN lines in place exceeded 90,000. Bell Atlantic has led the way with plans to operate seven million lines with ISDN access in 1991. The other RBOCs expect to have one to five million access lines by year-end. Non-RBOC companies including AT&T and GTE are also planning their own ISDN networks.

Not only does the number of RBOC-sponsored ISDN trials continue to grow, but the RBOCs are also beginning to lure large business customers to digital centrex with the promise that digital centrex is the path to ISDN services. As the progression toward ISDN continues, the RBOCs will continue to replace analog switches with digital switches. The percentage of RBOC access lines served by digital switches increased from less than 25 percent in 1988 to about 50 percent in 1990. By 1994, it should exceed 60 percent (Table 11, page 50).

Service Pricing Regulatory Trends

The pricing structure of most local telephone services is currently regulated by state public utility commissions (PUCs). LECs must file tariffs with their PUC explaining the service to be provided and the price structure for the service. If the tariff goes into effect, the LEC can begin offering the service. An increasing number of PUCs are being persuaded that, at least for some local services, such steps as measured pricing, off-tariff pricing, and even totally detariffed pricing are needed to ensure that the local telco is able to remain financially sound in an increasingly competitive environment. In fact, Nebraska is setting a trend by removing all telcos from most PUC rate regulation. Fifteen other states have detariffed at least some local services, and other states are considering similar action.

All the RBOCs are attempting to increase their ability to offer flexible service pricing or measured service pricings. NYNEX has foregone some price increases in exchange for measured service in New York. Ameritech has also achieved measured service (except for a three-year ban in Indiana). US West has made significant progress not just in Nebraska, but in New Mexico and other states as well. Even the California PUC, a traditional stronghold of telephone regulation, has been moving toward pricing flexibility on nonessential services.

Enhanced Services

Deregulatory trends of the late 1980s allowed the RBOCs to offer certain enhanced services directly (without having to market through a separate subsidiary), provided they complied with certain nonstructural safeguards including the requirement of comparably efficient interconnection (CEI). The ostensible purpose of CEI is to give third party vendors the ability to interconnect to the network features necessary to provide the services under the same conditions. Each time an RBOC wants to offer an enhanced service directly, it files a CEI plan with the FCC. In 1990, this process was disrupted when the 9th circuit U.S. Appeals Court remanded the FCC's decision to allow the RBOCs to market regulated network services and enhanced services jointly. As of this writing, the issue has not been fully resolved. The FCC has declared a moratorium on CEI plans pending resolution of the issue. Fig. 12, page 42 lists the status of various enhanced services offered by the RBOCs as of mid 1990.

Information Services

In July 1991, U.S. District Court lifted the AT&T antitrust consent decree's information services restrictions from the RBOCs. The court imposed a temporary stay of the regulatory relief pending review by the U.S. Court of Appeals and possibly the U.S. Supreme Court, a process expected to take over a year. Until a final judgment is imposed, industry participants should remain aware of the issues surrounding RBOC entry in all three of the lines of business restricted by the consent decree (information services, manufacturing, and long distance). Opponents maintain there is too great a risk of the RBOC's using ratepayer revenues to subsidize their movement into these businesses and eliminate competition from the market.

Sales Agency

Another competitive safeguard required of RBOCs wishing to sell equipment and certain business communication services together through a direct sales channel is the mandate that they provide independent sales agents the opportunity to sell network services. NATA successfully lobbied the FCC regarding the sales agency requirement. These independent agents, typically CPE vendors (*i.e.*, interconnects), are chosen by the RBOC and are given specific network services they are allowed to sell. The agent earns a commission from the RBOC on the sale of its network services.

The sales agency program has delivered several of the RBOCs a significant volume of sales in three product categories: centrex, other voice services, and both switched and data communications services. Agents have delivered sales far exceeding projected volumes for many services. In 1990, agents delivered more than $500 million in revenues to the telcos, earning eight to thirteen percent commission on each sale, depending on the product.

Dramatic growth is anticipated for each of the agency programs in 1991, even in light of the recession.

International Opportunities

All the RBOCs have organized international subsidiaries to explore new opportunities in foreign markets (see section on international developments). While the extent of the activity has been modest to date, international forays are nonetheless strategically important. Where many of their activities in the United States are subject to regulation, the RBOCs see the potential to participate more freely in the international telecommunications marketplace. Moreover, many markets abroad are growing more rapidly than those in the United States. In general, most foreign countries are hampered by a lower level of technology than the United States and need RBOC expertise to develop a modern, sophisticated telecommunications infrastructure. A sound telecommunications infrastructure has been determined to be an absolute requirement to attract business investment and ensure a sound economy.

COMPANY	NAME SERVICE	LOCATION
Ameritech	Voice messaging	Milwaukee, Wis., (westside); Brookfield, Wis. (Milwaukee area); Chicago suburbs; Worthington and Westerville, Ohio (Columbus area); Indianapolis and Carmel, Ind. (Indianapolis area)
	Heartland videotex gateway	Peoria County, Ill.
	Touch Four talking yellow pages	Green Bay, Madison, Milwaukee, Appleton, Wis.; Grand Rapids, Detroit metro area, Lansing, Holland, Grand Haven, Mich.; South Bend, Indianapolis, Ind.; Cleveland, Columbus, Ohio; western and northern Illinois
	Coin messaging	Columbus, Ohio
Bell Atlantic	AnswerCall/residential voice mail	Norfolk Va., Richmond, Va., Washington, D.C., suburbs in Md. and Va., suburban Philadelphia, and northern N.J.
	Intelligate/videotex gateway	Metropolitan Washington, D.C., Philadelphia/Delaware
	Electronic data interchange	Regionwide
	Send-A-Call/coin messaging	Washington, D.C.
	Talking Yellow Pages	Baltimore, Washington, D.C., Richmond, Tidewater, Va.
BellSouth	MemoryCall/voice messaging	West Palm Beach, Miami, Ft. Lauderdale and Gainesville, Fla.
	Class Notes/voice mail for schools	Atlanta, Memphis, Tenn.
	Transtext Universal Gateway (TUG)/videotex gateway	Atlanta
	Business TUG	Atlanta
	Message Central/electronic mail	Regionwide
	MemoryCall Public Telephone Service/coin messaging	Atlanta, New Orleans, Memphis, Tenn.
	CallFax/voice & facsimile response	Orlando, Fla.
Nynex	Info-Look/videotex gateway	Burlington, Vt., New York City, Boston
	Residential Call Answering & Business Call Answering/voice messaging	Boston, midtown Manhattan, suburban New York City
	FYI/talking yellow pages	Queens, Brooklyn, N.Y.
Pacific Telesis	Message Center/ residential voice mail	Milpitas, San Pedro, Calif.
	Pacific Bell Voice Mail (business)	San Francisco, Los Angeles, Sacramento, San Diego, Fresno, Santa Rosa, Orange County, Calif., Nevada
	Pacific Bell Connection/electronic messaging	San Francisco Bay Area
	California Call Management/voice store and forward	San Francisco, Los Angeles, Sacramento, San Diego
	Smart Talk/talking yellow pages	Sacramento, Calif.
Southwestern Bell	Voice messaging (business)	Dallas, Houston, San Antonio, Kansas City, St. Louis
	SelecTALK/talking yellow pages	Most major markets, some smaller markets
U S West	Voice messaging	Residential: Denver, Phoenix, Boise, Tucson, Albuquerque Small business (<100 lines): Denver, Omaha, Boise, Phoenix, Tucson, Albuquerque, Seattle, Colorado Springs Large business/government/education: Denver, Tucson, Phoenix, Albuquerque
	CommunityLink/videotex gateway	Omaha, Neb.
	Audio Options/voice-store-and-forward	Denver
	Electronic mail	Omaha, Neb.
	Talking Yellow Pages	Ten locations in major markets

Fig. 12 ENHANCED SERVICES SCOREBOARD©
Reprinted with permission from *Enhanced Services Outlook*, a publication of Telecom Publishing Group. For more information contact TPG Circulation Dept., P.O. Box 1455, Alexandria, VA 22313-2055, or telephone (703) 739-6400.

TIME LINE	NEWS & NOTES
Trials began 2/89 in Milwaukee area, 6/89 in Chicago area, 11/89 in Columbus area, 9/89 in Indianapolis area, 4/90 in Detroit. Trial extension sought until 3/91 in Chicago area. Indiana Bell will seek to tariff service in 3Q/90. Began transmitting non-profit service 4/90. Trials started 4/89, debuted 11/88 in Green Bay, Wis., 8/90 in Jackson, Kalamazoo, Mich. Six-month trial began 2/90.	17 voice messaging providers in Ameritech region, including **Ameritech Voice Messaging.** Only head-to-head competition is in one Indianapolis CO. Milwaukee area vendor, **All City Communications,** has attracted 675 customers out of 30,000 potential; 95% of them are residential. Cost is $6 res., $12 business. Ameritech is providing promotional and technical assistance to videotex gateway operated by non-profit **Heartland Free-net.** Touch Four audiotex gateway now available in 32 yellow pages directories in 11 markets. It handles over 1 million calls per month.
Trials began 1Q/89. Expanded rollout through 2Q/89 will include Washington, D.C., Harrisburg, Pittsburgh and Philadelphia, Pa., northern Delaware and metro Baltimore. Market trials began 1/89. Rollout scheduled 10/90. Washington, D.C., trial started 7/90. Trial started 1990.	"Tens of thousands" of voice mail customers cited in FCC filing. Intelligate has 56 IPs and 5,000 customers in Penn. and Delaware, and 109 IPs and 4,000 customers in Washington, D.C. Send-A-Call rolled out in July in 250 Washington, D.C., area pay phone locations; next trial sites are Philadelphia and New Brunswick, N.J. Vendor providing audiotex for talking yellow pages is **BDR Videotex USA.**
Voice messaging service, approved 12/88, will be added 9/90 in Jacksonville, Fla.; 10/90 in Atlanta; by end of year in Huntsville, Ala., Louisville, Ky., Baton Rouge, La., and Nashville, Tenn. Trial of educator's voice mail service started 4/89. Service began 8/88. Testing at two unnamed companies in Atlanta. Offered through separate subsidiary. Trial began 12/89. 12-month trial began 10/89.	Memory Call instructions are now available in Spanish/English in Miami. No plans to offer Spanish option in other locations. Class Notes up and running in two elementary schools in Atlanta and Memphis. Number of gateway customers has been frozen at approximately 3,000 users in Atlanta, due to RHC's skepticism that gateway could ever be profitable in the currently restrictive environment. BellSouth says it has 36,300 enhanced service "customers." That number includes 30,000 voice mail customers, 3,000 customers for its TUG gateway, and 3,300 locations for its MemoryCall public telephone/coin messaging service.
Trials began 12/88 in Burlington, 4/89 in New York, 3/90 in Boston. Back Bay Boston and Waltham, Mass. commercial rollouts began 7/89; midtown NYC began 3/90; suburban NYC began 6/90. Trial started 1990.	50 advertisers have bought front of the page ads for vendor-provided talking yellow pages trial. 11,000 customers have accessed Info-Look in its three locations since its introduction. Info-Look director Ellen Powley says RHC will not consider more locations as long as current restrictions are in place because of cost of transmitting information.
Trials began 3/89. San Francisco rollout scheduled 3Q/90. In California since 11/88, Nevada since 11/89. Rollout in Riverside, Calif., 3Q/90. Trials began 9/88, commercial rollout 4Q/90. Since 9/89. 12-month trial ends 12/90.	Three Pacific Bell Voice Mail products available: Series 50, 100, and 200. Products are price per mailbox ($10.95 to $19.95) or per port ($150 to $200). Free installation offered businesses. Pac Bell Directory is reconsidering use of voice storage and retrieval systems after audiotex gateway proved unsatisfactory in Smart Talk trial, which is being suspended 12/90. Pac Bell is advertising 900/976 IPs by category in Bay Area, starting this month with sports.
Trials conducted 7/88 to 6/89. Commercial rollout 10/89. Business service to launch in Austin and Tulsa August 15. Fort Worth, Oklahoma City, Tulsa, Wichita, Topeka, and Little Rock will launch service by end of year. Trial started 1989.	San Antonio business voice mail activated Aug. 1. SelecTalk vendors are Dallas-based **Audio Services Inc.**, Dallas-based **Southern Audiotext Inc.**, and Wichita, Kan.-based **Brite Voice Systems.**
Boise trial started 3/89; Denver rollout 8/89; Phoenix 10/89; Albuquerque 6/90. Boise trial 5/89; Omaha 6/89; Denver 10/89; Phoenix 2/90; Tucson 4/90; Seattle 5/90; Colorado Springs, Albuquerque 6/90. Denver, Phoenix, Tucson 5/90; Albuquerque 6/90. Startup 11/89. 8-month trial began 6/89. Trial began 10/89.	RHC is currently debating where to open second gateway. Leading prospects are Seattle and Minneapolis. Omaha gateway currently has 104 IPs with 750 individual services, and 2,975 end-users. Enough terminals and software have been distributed for 4,700 users. Negotiations with **Lincoln Telephone** to provide gateway exchange when independent telco begins service at year-end have broken off because of technical, cost factors. Exchange of gateway service will likely be made available by independent service bureaus instead. Talking yellow pages provided by Salt Lake City-based **Voice Directory of America.**

Fig. 12 ENHANCED SERVICES SCOREBOARD©
Reprinted with permission from *Enhanced Services Outlook*, a publication of Telecom Publishing Group For more information contact TPG Circulation Dept., P.O. Box 1455, Alexandria, VA 22313-2055, or telephone (703) 739-6400.

Table 7

Residential and Business Telephones Installed in Top 30 Metropolitan Areas 1985, 1990, and 1995

	1985		1990		1995	
City	Res. (000)	Business (000)	Res. (000)	Business (000)	Res. (000)	Business (000)
Atlanta	715	375	865	409	942	446
Baltimore	1,153	410	1,264	450	1,309	466
Boston	299	251	353	300	382	325
Chicago	1,926	881	2,116	968	2,215	1,014
Cincinnati	550	234	625	266	656	280
Cleveland	655	258	707	278	723	285
Columbus	332	161	387	188	412	201
Dallas/Fort Worth	907	293	1,080	349	1,176	380
Denver	1,186	499	1,336	613	1,466	691
Detroit	1,096	389	1,228	432	1,263	442
Houston	1,135	702	1,320	620	1,410	710
Indianapolis	477	199	544	228	568	238
Kansas City	325	194	364	218	428	229
Los Angeles	1,402	745	1,571	835	1,674	890
Miami	950	400	1,060	448	1,130	475
Milwaukee	619	255	677	279	707	292
Minneapolis/St. Paul	1,275	517	1,520	618	1,653	672
New Orleans	618	230	645	250	703	262
New York	4,056	1,825	4,344	1,954	4,520	2,033
Oklahoma City	587	242	690	285	750	310
Phoenix	1,211	400	1,640	543	1,907	632
Pittsburgh	554	264	605	288	625	298
Portland	343	202	404	244	440	269
Philadelphia	1,284	458	1,416	505	1,478	527
St. Louis	394	205	442	230	463	241
San Diego	411	234	513	293	571	326
San Francisco	521	420	592	478	636	514
San Jose	530	233	685	301	768	337
Seattle	452	295	554	362	606	395
Washington	549	624	634	722	679	773

Source: NATA Market Research Department

Table 8

THE TOP 150

Largest Telephone Companies Reporting to USTA, Including Holding Companies

In Order of Access Lines[1] As of December 31, 1989	Access Lines	Operating Revenues
1. **Bell Atlantic Corp.** • Philadelphia, Pennsylvania	17,056,802	10,226,894,000
2. **BellSouth Corp.** • Atlanta, Georgia	16,720,367	11,995,872,345
3. **Ameritech Corp.** • Chicago, Illinois	15,899,000	9,353,339,000
4. **NYNEX** • New York, New York	14,960,953	11,086,660,000
5. **Pacific Telesis Group** • San Francisco, California	14,202,949	7,998,678,086
6. **US West Communications** • Englewood, Colorado	12,306,536	8,128,848,000
7. **GTE Corp. (US Only)** • Irving, Texas	12,300,000	9,558,000,000
8. **Southwestern Bell Corp.** • St. Louis, Missouri	11,444,061	7,408,690,000
9. **United Telecommunications, Inc.** • Overland Park, Kansas	3,811,980	2,365,400,000
10. **Contel Service Corp.** • Atlanta, Georgia	2,591,090	2,120,605,610
11. **Southern New England Telephone Co.** • New Haven, Connecticut	1,875,000	1,419,414,000
12. **Centel Corp.** • Chicago, Illinois	1,590,716	886,051,000
13. **ALLTEL Corp.** • Hudson, Ohio	1,123,590	801,575,000
14. **Puerto Rico Telephone Co.** San Juan, Puerto Rico	803,713	591,586,958
15. **Cincinnati Bell Telephone Co.** • Cincinnati, Ohio	781,064	489,119,931
16. **Rochester Telephone Corp.** • Rochester, New York	610,338	359,880,000
17. **Century Telephone Enterprises, Inc.** • Monroe, Louisiana	296,034	190,538,000
18. **Telephone & Data Systems, Inc.**† Chicago, Illinois	263,914	168,046,000
19. **Pacific Telecom, Inc.** * Vancouver, Washington	252,732	211,967,000
20. **Lincoln Telephone & Telegraph Co.** ** Lincoln, Nebraska	219,417	128,220,545
21. **C-TEC Corp.** ** Wilkes-Barre, Pennsylvania	185,338	101,535,473
22. **Anchorage Telephone Utility** Anchorage, Alaska	118,881	83,714,406
23. **Puerto Rico Communications Authority** San Juan, Puerto Rico	114,700	75,880,379
24. **Citizens Utilities Co.** ** Stamford, Connecticut	109,669	139,330,820
25. **North State Telephone Co.** High Point, North Carolina	87,237	42,830,579
26. **Illinois Consolidated Telephone Co.** Mattoon, Illinois	76,719	52,972,542
27. **Concord Telephone Co.** Concord, North Carolina	74,500	27,884,341
28. **Roseville Telephone Co.** * Roseville, California	71,937	58,079,173
29. **North-West Telecommunications, Inc.** ** Tomah, Wisconsin	64,574	34,653,099
30. **Lufkin-Conroe Telephone Exchange** Lufkin, Texas	60,664	54,279,425
31. **Virgin Islands Telephone Corp.** St. Thomas, Virgin Islands	46,378	53,168,000
32. **North Pittsburgh Telephone Co.** Gibsonia, Pennsylvania	43,222	32,859,662
33. **Standard Telephone Co.** Cornelia, Georgia	41,327	29,645,108
34. **Conestoga Telephone & Telegraph Co.** * Birdsboro, Pennsylvania	41,062	21,214,132
35. **Horry Telepone Cooperative, Inc.** Conway, South Carolina	40,630	20,240,185
36. **Telephone Electronics Corp./ FAIL, Inc.** Jackson, Mississippi	40,592	26,650,268
37. **Denver and Ephrata Telephone and Telegraph Co.** Ephrata, Pennsylvania	40,177	23,834,310
38. **Farmers Telephone Coop., Inc.** Kingstree, South Carolina	36,495	22,811,958
39. **Pioneer Telephone Coop., Inc.** Kingfisher, Oklahoma	36,114	28,504,967
40. **SLT Communications, Inc.** Sugar Land, Texas	35,755	28,693,718
41. **Guam Telephone Authority** Tamuning, Guam	35,553	22,999,503
42. **Rock Hill Telephone Co.** Rock Hill, South Carolina	34,923	21,803,554
43. **Hargray Telephone Co., Inc.** Hilton Head Island, South Carolina	30,172	22,998,337
44. **Clifton Forge-Waynesboro Telephone Co.** * Staunton, Virginia	28,163	19,085,590
45. **Matanuska Telephone Assn., Inc.** Palmer, Alaska	27,701	31,186,251
46. **Mankato Citizens Telephone Co.** Mankato, Minnesota	27,409	18,566,224
47. **Chillicothe Telephone Co.** Chillicothe, Ohio	26,705	18,545,601
48. **Gulf Telephone Co.** Foley, Alabama	25,100	16,190,635
49. **Great Plains Communications, Inc.** Blair, Nebraska	24,965	16,156,050
50. **Fairbanks Municipal Utilities System** Fairbanks, Alaska	24,704	22,019,108

Source: Reprinted with permission of USTA

Table 8

In Order of Access Lines[1] As of December 31, 1989	Access Lines	Operating Revenues
51. **Lexington Telephone Co.** Lexington, North Carolina	24,455	16,703,933
52. **Twin Lakes Telephone Coop.** Gainesboro, Tennessee	24,276	10,097,259
53. **Ben Lomand Rural Telephone Coop., Inc.** McMinnville, Tennessee	22,755	11,144,201
54. **Northern States Power Co.** * Minot, North Dakota	21,761	10,534,645
55. **Smithville Telephone Co., Inc.** Ellettsville, Indiana	21,745	10,602,597
56. **Wood County Telephone Co.** Wisconsin Rapids, Wisconsin	21,280	9,903,111
57. **East Ascension Telephone Co., Inc.** Gonzales, Louisiana	21,161	15,543,961
58. **St. Joseph Telephone & Telegraph Co.** Port St. Joe, Florida	20,896	17,911,399
59. **Taconic Telephone Corp.** Chatham, New York	20,710	12,490,317
60. **Coastal Utilities, Inc.** Hinesville, Georgia	20,671	17,418,971
61. **Eastex Telephone Coop., Inc.** Henderson, Texas	20,628	15,769,820
62. **Atlantic Telephone Membership Corp.** Shallotte, North Carolina	19,766	8,487,092
63. **South Central Rural Telephone Coop. Corp., Inc.** Glasgow, Kentucky	19,639	11,296,345
64. **San Marcos Telephone Co.** San Marcos, Texas	19,324	16,718,842
65. **Yadkin Valley Telephone Membership Corp.** Yadkinville, North Carolina	18,991	9,373,003
66. **Brandenburg Telephone Co., Inc.** Brandenburg, Kentucky	18,536	9,794,522
67. **Mid-Plains Telephone, Inc.** * Middleton, Wisconsin	18,268	8,745,352
68. **Millington Telephone Co., Inc.** Millington, Tennessee	18,102	9,136,396
69. **Grand River Mutual Telephone Corp.** Princeton, Missouri	17,983	10,256,716
70. **Warwick Valley Telephone Co.** * Warwick, New York	17,719	9,693,591
71. **Ogden Telephone Co.** * Spencerport, New York	17,642	7,555,310
72. **Fort Bend Telephone Co., Inc.** Rosenberg, Texas	17,525	15,002,376
73. **Highland Telephone Coop., Inc.** Sunbright, Tennessee	16,736	8,067,486
74. **Shenandoah Telephone Co.** Edinburg, Virginia	16,671	10,050,300
75. **Ace Telephone Assn.** Houston, Minnesota	16,456	8,675,697
76. **Lancaster Telephone Co.** Lancaster, South Carolina	16,388	9,243,136
77. **Guadalupe Valley Telephone Coop., Inc.** New Braunfels, Texas	15,710	14,226,918
78. **Missouri Telephone Co.** Bolivar, Missouri	15,524	7,624,819
79. **Woodbury Telephone Co.** * Woodbury, Connecticut	15,483	11,068,006
80. **Buffalo Valley Telephone Co.** * Lewisburg, Pennsylvania	15,137	9,566,306
81. **Rhinelander Telephone Co.** * Rhinelander, Wisconsin	14,546	7,326,729
82. **Kerrville Telephone Co.** Kerrville, Texas	14,532	10,896,835
83. **Ellensburg Telephone Co., Inc.** * Ellensburg, Washington	14,435	9,541,054
84. **Farmers Telephone Coop., Inc.** Rainsville, Alabama	14,302	7,658,806
85. **Harrisonville Telephone Co.** Waterloo, Illinois	14,188	8,881,975
86. **North Central Telephone Coop., Inc.** Lafayette, Tennessee	13,807	6,389,348
87. **Arvig Telecom** Pequot Lakes, Minnesota	13,586	9,514,836
88. **Statesboro Telephone Co., Inc.** Statesboro, Georgia	13,573	9,556,569
89. **West Kentucky Rural Telephone Coop. Corp., Inc.** Mayfield, Kentucky	13,559	6,517,498
90. **Home Telephone Co., Inc.** Moncks Corner, South Carolina	13,556	9,108,155
91. **Citizens Telephone Co.** Brevard, North Carolina	13,530	7,993,755
92. **Craw-Kan Telephone Coop., Inc.** Girard, Kansas	13,353	8,032,288
93. **Sierra Telephone Co., Inc.** Oakhurst, California	13,183	19,255,761
94. **East Otter Tail Telephone Co.** Perham, Minnesota	13,119	7,983,991
95. **DeKalb Telephone Coop., Inc.** Alexandria, Tennessee	13,069	7,364,255
96. **Garden Valley Telephone Co.** Erskine, Minnesota	12,911	7,606,360
97. **UTELCO, Inc.** Monroe, Wisconsin	12,782	7,289,195
98. **Chester Telephone Co.** Chester, South Carolina	12,341	6,658,038
99. **Star Telephone Membership Corp.** Clinton, North Carolina	12,196	5,408,302
100. **Southland Telephone Co.** Atmore, Alabama	11,973	8,231,010
101. **Souris River Telephone Mutual Aid Coop.** Minot, North Dakota	11,413	7,789,032
102. **LaFourche Telephone Co., Inc.** LaRose, Louisiana	11,353	13,905,710
103. **Pioneer Telephone Association, Inc.** Ulysses, Kansas	11,332	9,327,593

Source: Reprinted with permission of USTA

Table 8

In Order of Access Lines[1] As of December 31, 1989	Access Lines	Operating Revenues
104. **Golden West Telecommunications Coop., Inc.** Wall, South Dakota	10,985	7,591,252
105. **Camden Telephone Co.** St. Marys, Georgia	10,942	7,535,257
106. **New Ulm Telecommunications, Inc.** New Ulm, Minnesota	10,551	5,456,987
107. **Foothills Rural Telephone Coop. Corp., Inc.** Staffordsville, Kentucky	10,533	4,697,667
108. **Monroeville Telephone Co.** Monroeville, Alabama	10,327	7,896,475
109. **Pioneer Telephone Coop.** Philomath, Oregon	10,258	5,170,613
110. **Mountain Rural Telephone Coop. Corp., Inc.** West Liberty, Kentucky	10,094	5,364,670
111. **Brookings Municipal Telephone Company** Brookings, South Dakota	10,065	4,699,261
112. **Fidelity Telepone Co.** Sullivan, Missouri	9,981	7,809,000
113. **Sandhill Telephone Coop., Inc.** Jefferson, South Carolina	9,928	5,113,976
114. **ENMR Telephone Coop.** Clovis, New Mexico	9,858	17,894,568
115. **Fort Mill Telephone Co.** Fort Mill, South Carolina	9,774	5,498,500
116. **Surry Telephone Membership Corp.** Dobson, North Carolina	9,625	4,330,530
117. **The North-Eastern Pennsylvania Telephone Co.** Forest City, Pennsylvania	9,573	5,777,790
118. **Lakedale Telephone Co.** Annandale, Minnesota	9,490	4,820,451
119. **Chautauqua & Erie Telephone Co.** Westfield, New York	9,390	5,750,618
120. **Brindlee Mountain Telephone Co.** Arab, Alabama	9,336	5,737,570
121. **Interstate Telephone Co., Inc.** West Point, Georgia	9,257	5,779,451
122. **Etex Telephone Coop., Inc.** Gilmer, Texas	9,026	5,763,461
123. **Champaign Telephone Co.** Urbana, Ohio	9,019	6,993,092
124. **Piedmont Rural Telephone Coop., Inc.** Laurens, South Carolina	9,010	5,275,164
125. **Palmetto Rural Telephone Coop., Inc.** Walterboro, South Carolina	8,991	4,978,065
126. **Hill Country Telephone Coop.** Ingram, Texas	8,927	9,087,163
127. **Palmerton Telephone Co.** Palmerton, Pennsylvania	8,926	6,339,550
128. **Wilkes Telephone & Electric Co.** Washington, Georgia	8,822	4,003,610
129. **Churchill County Telephone** Fallon, Nevada	8,713	6,187,952
130. **Community Service Telephone Co.** Winthrop, Maine	8,677	4,592,511
131. **Polar Communications Mutual Aid Corp.** Park River, North Dakota	8,668	4,288,547
132. **West River Mutual Aid Telephone Corp.** Hazen, North Dakota	8,607	3,908,122
133. **Duo County Telephone Coop. Corp., Inc.** Jamestown, Kentucky	8,567	4,497,699
134. **Scott-Rice Telephone Company** Prior Lake, Minnesota	8,455	4,753,692
135. **West Carolina Rural Telephone Coop., Inc.** Abbeville, South Carolina	8,311	3,955,849
136. **Clay County Rural Telephone Coop., Inc.** Cloverdale, Indiana	8,273	4,601,886
137. **Evans Telephone Co.** Turlock, California	8,236	9,846,861
138. **Pineland Telephone Coop., Inc.** Metter, Georgia	8,154	4,922,538
139. **Interstate Teleommunications Coop., Inc.** Clear Lake, South Dakota	8,017	4,167,475
140. **Ringgold Telephone Co.** Ringgold, Georgia	7,925	5,185,568
141. **Pond Branch Telephone Co., Inc.** Gilbert, South Carolina	7,883	4,775,834
142. **Three Rivers Telephone Coop., Inc.** Fairfield, Montana	7,766	6,186,927
143. **Triangle Telephone Coop. Assn., Inc.** Havre, Montana	7,742	6,475,668
144. **Melrose Telephone Co.** Melrose, Minnesota	7,736	4,814,030
145. **Volcano Telephone Co.** Pine Grove, California	7,728	10,158,812
146. **Public Service Telephone Co.** Reynolds, Georgia	7,716	7,314,420
147. **Telephone Service Company** Wapakoneta, Ohio	7,690	4,390,276
148. **Hutchinson Telephone Co.** Hutchinson, Minnesota	7,469	4,991,492
149. **Gulf Telephone Co.** Perry, Florida	7,449	3,909,758
150. **Wilkes Telephone Membership Corp.** Millers Creek, North Carolina	7,364	3,751,046

---

[1] For year end 1989, USTA requested the reporting companies not include official communications or test lines in their calculation of total access lines.

- • Company or parent listed on New York Stock Exchange
- † Company or parent listed on American Stock Exchange
- ° Over-the-counter Market
- °° Company or parent listed on NASDAQ

Source: Reprinted with permission of USTA

Table 9

Selected Financial Information of the Regional Bell Operating Companies as of December 31, 1990

	Ameritech	Bell Atlantic	Bell-South	NYNEX	PACTEL	SW Bell	US West	Total or Average
($ millions)								
Total Revenue	10,662	12,298	14,345	13,585	9,716	9,113	9,957	79,676
Local Service	4,789	4,617	5,707	5,651	3,153	3,397	3,390	30,704
Network Access	2,568	2,970	3,754	3,292	2,240	2,631	2,680	20,135
Long Distance	1,336	1,544	1,565	1,365	2,211	1,065	1,493	10,579
Other	1,970	3,167	3,319	3,277	2,112	2,020	2,394	18,259
Expenses and Income Tax	9,408	10,986	12,713	12,636	8,686	8,012	8,758	71,199
Net Income	1,254	1,312	1,632	949	1,030	1,101	1,199	8,477
Shares Outstanding Average	265	394	482	199	404	300	386	347
Total Assets	21,715	27,999	30,207	26,651	21,581	22,196	27,050	25,343
Long Term Debt	5,074	8,171	7,781	6,945	5,611	5,483	7,175	6,606
($ thousands)								
Customer Access Line	16.3	17.5	17.5	15.3	14.1	12.1	12.6	15.1
Number of Employees	75.8	81.6	101.9	93.8	65.8	66.7	65.5	78.7
($)								
Earnings per Share	4.73	3.38	3.38	4.78	2.59	3.67	3.11	3.66
Dividends per Share	3.22	2.36	2.68	4.56	2.02	2.76	2.00	2.80

Source: Company Annual Reports

Table 10

Selected Financial Information of Carriers as of December 31, 1990

SELECTED FINANCIAL DATA	ALC COMMUNICATIONS CORP.	AT&T	AMERITECH	BELL ATLANTIC CORP.	BELL SOUTH CORP.	CENTEL CORP.
REVENUES	326	1/ 37,285	10,663	12,298	14,345	1,149
COSTS & EXPENSES	329	32,460	8,473	9,688	11,315	959
INTEREST EXPENSE	21	828	475	660	774	135
OTHER INCOME & ADJUSTMENTS 2/	4	232	96	32	153	34
INCOME TAXES	0	1,494	557	670	778	24
NET INCOME	(20)	2,735	1,254	1,312	1,631	65
EARNINGS PER SHARE	(0.46)	2.51	4.73	3.38	3.38	0.75
DIVIDENDS PER SHARE	0	1.32	3.22	236	2.68	0.85
AVG. SHARES OUTSTANDING (MIL)	55	1,089	265	394	482	84
TOTAL ASSETS	149	43,775	21,715	27,999	30,207	3,543
PROPERTY, PLANT & EQUIP. (NET)	46	17,472	16,652	19,447	23,907	1,986
LONG TERM DEBT	22	9,118	5,074	8,171	7,781	1,420
SHAREHOLDERS' EQUITY	(102)	14,093	7,732	8,930	12,666	1,101
OPERATING DATA:						
CUSTOMER LINES (THOUS)	-	-	16,278	17,484	17,500	1,856
NUMBER OF EMPLOYEES	1,481	273,700	75,780	81,600	101,945	12,317

SELECTED FINANCIAL DATA	CONTEL CORP.	G T E CORP.	M C I CORP.	NYNEX CORP.	PACIFIC TELESIS GROUP	PACIFICORP
REVENUES	3,423	18,374	7,680	13,585	9,716	3,783
COSTS & EXPENSES	2,868	14,922	7,060	11,570	7,489	2,695
INTEREST EXPENSE	351	1,011	213	700	649	377
OTHER INCOME & ADJUSTMENTS 2/	72	(211)	33	2	71	27
INCOME TAXES	89	689	141	368	619	210
NET INCOME	187	1,541	299	949	1,030	474
EARNINGS PER SHARE	1.17	2.26	1.06	4.78	2.59	1.35
DIVIDENDS PER SHARE	1.10	1.52	0	4.56	2.02	1.41
AVG. SHARES OUTSTANDING (MIL)	160	664	296	199	404	244
TOTAL ASSETS	7,363	33,769	8,249	26,651	21,581	12,372
PROPERTY, PLANT & EQUIP. (NET)	4,879	24,532	5,033	19,729	17,160	8,103
LONG TERM DEBT	1,983	11,974	3,147	6,945	5,611	4,672
SHAREHOLDERS' EQUITY	1,713	9,100	2,340	9,149	7,401	3,600
OPERATING DATA:						
CUSTOMER LINES (THOUS)	2,700	15,736	-	15,303	14,112	340
NUMBER OF EMPLOYEES	21,824	154,000	24,509	93,800	65,829	16,426

SELECTED FINANCIAL DATA	ROCHESTER TELEPHONE CORP.	SOUTHWESTERN BELL CORP.	US WEST	UNITED TELECOM	WESTERN UNION CORP.	WILLIAMS COMPANIES
REVENUES	562	9,113	9,957	8,345	593	1,822
COSTS & EXPENSES	455	7,061	7,524	7,491	541	1,607
INTEREST EXPENSE	26	584	733	397	125	142
OTHER INCOME & ADJUSTMENTS 2/	16	73	60	5	224	29
INCOME TAXES	25	440	561	153	2	25
NET INCOME	72	1,101	1,199	309	149	77
EARNINGS PER SHARE	2.82	3.67	3.11	1.43	0.59	1.58
DIVIDENDS PER SHARE	1.42	2.76	2.00	1.00	0	1.40
AVG. SHARES OUTSTANDING (MIL)	25	300	386	214	95	41
TOTAL ASSETS	1,053	22,196	27,050	10,553	275	4,034
PROPERTY, PLANT & EQUIP. (NET)	757	16,322	18,103	8,352	55	2,994
LONG TERM DEBT	338	5,483	7,175	3,974	676	1,368
SHAREHOLDERS' EQUITY	417	8,581	9,240	2,300	(860)	1,167
OPERATING DATA:						
CUSTOMER LINES (THOUS)	610	12,105	12,562	3,947	-	-
NUMBER OF EMPLOYEES	3,687	66,700	65,469	43,100	2,150	3,797

SOURCE: COMPANY ANNUAL REPORTS TO SHAREHOLDERS AND ANNUAL REPORTS FORM 10-K.

1/ OPERATING REVENUES AND EXPENSES FOR AT&T ARE NET OF $14,036 MILLION ACCESS CHARGES.

2/ INCLUDES EXTRAORDINARY ITEMS.

Source: Federal Communications Commission

Table 11

Advanced Technology Deployment by Regional Bell Operating Companies, 1990 and 1994

	ISDN		Digital Deployment		Fiber Deployment	CCSS7 Deployment	
	% of CO's	% of Access Lines	% of CO's	% of Access Lines	% of total miles of Cable	% of CO's	% of Access Lines
Ameritech							
1990	6.0	.3	64.5	40.4	3.8	24.1	42.6
1994	13.3	.7	77.7	54.5	6.1	55.6	66.8
Bell Atlantic							
1990	7.6	.1	72.9	48.3	4.7	54.7	75.5
1994	86.8	1.2	86.8	65.5	10.4	91.3	91.6
BellSouth							
1990	3.3	1.9	78.2	51.1	4.2	34.2	57.8
1994	33.5	7.9	82.9	66.4	7.5	94.6	95.5
Nynex							
1990	2.6	.2	57.9	56.7	4.1	14.1	8.1
1994	4.1	.3	85.0	70.2	6.9	75.2	89.1
PacTel							
1990	4.2	.1	59.4	35.6	2.8	32.3	30.7
1994	14.4	.3	66.9	43.1	5.2	34.0	31.8
SW Bell							
1990	3.4	.2	31.9	25.8	2.6	1.3	3.1
1994	7.2	.6	74.4	44.9	3.4	24.9	66.5
US West							
1990	4.8	.4	38.4	35.3	4.1	1.0	2.1
1994	6.9	.5	55.5	44.0	7.9	18.3	53.8

Source: Statement on behalf of the International Communications Association before the Subcommittee on Telecommunications and Finance of the Committee on Energy and Commerce of the U.S. House of Representatives, May 10, 1990

Table 12

Outside Plant Statistics of Reporting Local Exchange Companies as of December 31, 1990

STATE	MILES OF AERIAL WIRE	AERIAL CABLE		UNDERGROUND CABLE		BURIED CABLE		SUBMARINE CABLE	
		MILES OF CABLE	MILES OF STRAND IN CABLE	MILES OF CABLE	MILES OF STRAND IN CABLE	MILES OF CABLE	MILES OF STRAND IN CABLE	MILES OF CABLE	MILES OF STRAND IN CABLE
ALABAMA	20,685	27,386	6,760,126	4,015	7,566,142	38,363	9,273,846	21	28,185
ARIZONA	12,045	8,044	1,533,805	6,237	13,465,349	25,653	9,864,588	1	24
ARKANSAS	11,551	6,810	1,792,869	1,654	3,006,673	33,784	6,307,753	20	8,608
CALIFORNIA	72,299	112,198	35,217,954	70,949	131,920,780	80,033	20,574,589	193	164,978
COLORADO	24,116	8,919	1,628,461	6,967	14,182,873	38,633	7,843,293	4	2,094
CONNECTICUT	60	27,865	10,213,132	5,299	10,632,385	3,994	1,108,508	56	58,712
DELAWARE	0	2,404	1,016,696	823	1,979,028	5,982	1,625,523	2	3,102
DIST. OF COLUMBIA	0	707	388,972	1,926	5,117,697	61	20,822	16	36,573
FLORIDA	9,955	34,669	8,810,234	21,166	41,618,695	122,279	40,532,576	184	276,031
GEORGIA	55,342	38,297	10,167,041	9,744	16,328,025	65,620	14,207,336	20	8,421
HAWAII	8,941	6,994	1,947,975	2,258	1,601,064	405	58,298	5	1,216
IDAHO	3,398	3,011	487,661	1,044	1,844,681	22,021	3,203,009	105	7,766
ILLINOIS	13,756	28,333	7,008,593	19,845	39,659,430	97,884	15,588,922	14	14,765
INDIANA	11,627	25,706	5,949,900	7,602	12,571,210	51,820	8,406,653	7	9,430
IOWA	299	3,248	642,090	2,981	5,184,492	45,144	6,837,695	23	19,993
KANSAS	2,205	4,956	1,288,712	2,946	5,022,116	36,803	6,488,187	4	1,087
KENTUCKY	21,082	35,610	8,147,421	3,822	6,421,642	20,958	4,157,974	5	1,016
LOUISIANA	3,402	14,855	4,901,631	5,506	11,905,374	44,002	11,331,282	92	131,734
MAINE	18,699	22,270	4,937,538	924	1,532,458	1,542	442,960	84	30,120
MARYLAND	0	24,474	12,916,269	4,813	12,537,166	20,274	6,753,864	43	48,737
MASSACHUSETTS	8,569	45,392	16,535,495	12,450	22,926,826	5,754	2,045,845	49	68,705
MICHIGAN	12,062	36,769	10,747,919	14,850	30,798,243	101,699	20,356,506	45	43,926
MINNESOTA	3,073	5,177	1,014,165	6,345	11,968,951	50,234	10,731,109	58	44,235
MISSISSIPPI	13,542	22,360	5,904,147	1,735	3,330,747	39,145	6,178,469	20	21,042
MISSOURI	10,072	26,950	5,379,582	6,885	12,498,426	74,363	12,008,059	30	8,283
MONTANA	7,143	2,732	504,894	618	1,041,569	21,655	2,095,901	1	249
NEBRASKA	744	2,003	647,205	1,864	3,496,587	43,859	4,762,823	6	2,952
NEVADA	5,857	4,658	1,430,006	3,437	4,692,782	5,653	1,307,005	0	0
NEW HAMPSHIRE	8,286	17,642	4,937,239	1,205	2,422,850	2,325	779,188	32	14,822
NEW JERSEY	0	33,899	20,546,273	12,992	30,534,573	9,038	3,609,406	74	127,339
NEW MEXICO	4,436	5,751	1,082,214	1,727	2,942,900	15,469	3,267,415	1	19
NEW YORK	63,890	74,690	27,856,658	28,731	64,115,592	40,170	10,415,248	420	144,449
NORTH CAROLINA	25,914	30,610	9,486,824	6,880	10,652,162	89,181	17,174,760	37	25,740
NORTH DAKOTA	195	521	111,145	471	992,247	23,184	2,714,808	2	987
OHIO	27,939	68,923	18,270,727	15,410	25,228,079	61,387	9,962,247	33	21,177
OKLAHOMA	11,078	8,241	2,168,454	3,923	7,572,916	55,046	10,132,772	53	15,572
OREGON	26,946	11,395	2,602,801	4,264	7,794,260	21,425	4,338,235	25	24,483
PENNSYLVANIA	15,475	78,191	25,466,242	12,441	27,206,635	21,559	4,390,309	6	6,744
RHODE ISLAND	2,678	7,164	2,623,757	1,610	3,380,304	605	281,666	12	5,774
SOUTH CAROLINA	8,214	9,622	3,180,530	3,925	5,859,320	37,538	8,864,474	6	3,275
SOUTH DAKOTA	436	651	96,780	655	1,145,721	22,859	2,559,526	7	1,509
TENNESSEE	26,620	39,021	9,276,843	5,220	10,442,419	37,065	9,825,497	10	20,369
TEXAS	65,878	60,084	17,330,013	26,087	56,221,415	182,629	43,042,644	77	47,295
UTAH	3,664	3,757	707,917	2,050	4,003,244	10,985	4,039,414	1	112
VERMONT	12,163	12,062	2,322,322	411	674,815	1,615	493,408	12	4,152
VIRGINIA	11,734	41,836	11,560,060	6,050	15,325,588	64,936	15,148,947	17	13,370
WASHINGTON	22,107	15,677	3,723,317	7,787	15,194,598	35,278	8,287,100	127	70,504
WEST VIRGINIA	1,142	22,850	6,494,178	918	1,791,304	10,369	1,500,119	8	14,315
WISCONSIN	13,184	14,079	3,667,243	5,376	9,984,063	56,358	9,597,902	162	39,653
WYOMING	913	996	185,850	535	1,020,403	16,296	2,254,159	2	120
UNITED STATES	703,416	1,140,461	341,617,880	377,372	739,356,819	1,912,935	406,792,640	2,232	1,643,764
PUERTO RICO	37,748	11,097	4,688,626	1,640	3,228,448	2,507	995,144	0	0
OCEAN CABLE	0	0	0	0	0	0	0	0	0
GRAND TOTAL	741,164	1,151,558	346,306,506	379,012	742,585,267	1,915,441	407,787,783	2,232	1,643,764

Source: Federal Communications Commission

Table 12

Outside Plant Statistics of Reporting Local Exchange Companies as of December 31, 1990

	DEEP SEA CABLE		INTRABUILDING NETWORK CABLE		TOTAL CABLE		MILES OF FIBER IN CABLE	
STATE	MILES OF CABLE	MILES OF STRAND IN CABLE	MILES OF CABLE	MILES OF STRAND IN CABLE	MILES OF CABLE	MILES OF STRAND IN CABLE	FIBER MILES EQUIPPED WITH ELECTRONICS (LIT)	TOTAL FIBER MILES DEPLOYED (LIT AND DARK)
ALABAMA	0	0	412	132,061	70,197	23,760,360	10,674	38,940
ARIZONA	0	0	1,259	447,642	41,194	25,311,409	10,314	39,374
ARKANSAS	0	0	245	73,265	42,513	11,189,169	2,277	13,207
CALIFORNIA	0	0	14,253	4,507,840	277,628	192,386,142	31,323	227,623
COLORADO	0	0	1,783	670,910	56,306	24,327,631	16,919	50,423
CONNECTICUT	0	0	1,650	699,222	38,864	22,711,959	17,524	54,109
DELAWARE	0	0	114	52,287	9,325	4,676,636	2,724	10,917
DIST. OF COLUMBIA	0	0	992	675,635	3,702	6,239,699	4,696	11,960
FLORIDA	0	0	1,245	502,294	179,543	91,739,830	97,764	218,584
GEORGIA	0	0	795	338,194	114,476	41,049,017	54,577	152,012
HAWAII	0	0	248	57,927	9,910	3,666,480	0	2,503
IDAHO	0	0	245	50,357	26,426	5,593,474	4,364	8,555
ILLINOIS	0	0	2,266	827,350	148,342	63,099,060	73,384	114,498
INDIANA	0	0	1,363	392,990	86,498	27,330,183	14,117	51,424
IOWA	0	0	204	61,391	51,600	12,745,661	7,785	24,084
KANSAS	0	0	154	42,768	44,864	12,842,870	10,466	52,329
KENTUCKY	0	0	435	96,648	60,830	18,824,701	7,493	43,455
LOUISIANA	0	0	948	312,665	65,403	28,582,686	7,298	40,610
MAINE	0	0	0	0	24,820	6,943,076	9,458	23,410
MARYLAND	0	0	1,928	752,571	51,532	33,008,607	32,381	95,240
MASSACHUSETTS	0	0	0	0	63,645	41,576,871	45,087	127,007
MICHIGAN	0	0	3,862	1,228,552	157,225	63,175,146	32,790	123,453
MINNESOTA	0	0	453	209,893	62,267	23,968,353	8,310	50,510
MISSISSIPPI	0	0	374	112,178	63,634	15,546,583	34,914	34,914
MISSOURI	0	0	792	260,082	109,020	30,154,431	14,996	87,930
MONTANA	0	0	312	45,706	25,318	3,688,319	1,111	3,373
NEBRASKA	0	0	306	88,624	48,037	8,998,190	9,564	33,369
NEVADA	0	0	302	78,272	14,050	7,508,065	1,693	5,394
NEW HAMPSHIRE	0	0	0	0	21,204	8,154,099	12,013	38,750
NEW JERSEY	0	0	2,175	1,079,424	58,178	55,897,015	31,850	119,293
NEW MEXICO	0	0	419	113,292	23,367	7,405,840	4,221	18,627
NEW YORK	0	0	13,735	6,140,225	157,746	108,672,172	5,167	266,741
NORTH CAROLINA	0	0	586	132,472	127,294	37,521,958	61,221	103,690
NORTH DAKOTA	0	0	203	49,719	24,381	3,868,906	12,792	21,608
OHIO	0	0	3,951	1,083,747	149,704	54,565,977	32,288	81,068
OKLAHOMA	0	0	529	181,680	67,792	20,071,394	7,983	43,019
OREGON	0	0	548	156,904	37,657	14,916,683	8,116	33,261
PENNSYLVANIA	0	0	2,323	924,122	114,520	57,994,052	35,070	143,556
RHODE ISLAND	0	0	0	0	9,391	6,291,501	5,577	16,599
SOUTH CAROLINA	0	0	865	273,485	51,956	18,181,084	27,317	60,486
SOUTH DAKOTA	0	0	212	51,699	24,384	3,855,235	5,996	20,675
TENNESSEE	0	0	658	253,676	81,973	29,818,804	39,986	43,743
TEXAS	0	0	2,881	1,225,611	271,759	117,866,978	42,392	224,923
UTAH	0	0	615	193,868	17,408	8,944,555	2,887	9,852
VERMONT	0	0	0	0	14,100	3,494,697	5,131	10,080
VIRGINIA	0	0	1,538	808,782	114,377	42,856,747	56,229	141,441
WASHINGTON	0	0	1,768	592,244	60,637	27,867,763	14,000	67,534
WEST VIRGINIA	0	0	405	111,921	34,550	9,911,837	13,718	37,309
WISCONSIN	0	0	1,040	371,672	77,015	23,660,533	22,232	46,045
WYOMING	0	0	260	56,482	18,089	3,517,014	2,320	9,814
UNITED STATES	0	0	71,651	26,568,349	3,504,650	1,515,979,452	1,012,509	3,297,321
PUERTO RICO	0	0	5	762	15,249	8,912,979	11,804	13,453
OCEAN CABLE	1,247	270,362	0	0	1,247	270,362	0	0
GRAND TOTAL	1,247	270,362	71,656	26,569,111	3,521,146	1,525,162,793	1,024,313	3,310,774

Source: Federal Communications Commission

Table 12

Outside Plant Statistics of Reporting Local Exchange Companies as of December 31, 1990

		RADIO RELAY SYSTEM				CONDUIT SYSTEM	
STATE	EQUIPPED MILES OF TUBE IN COAXIAL CABLE	MILES OF SYSTEM	MILES OF RADIO CHANNEL	MILES OF EQUIVALENT 4KHZ TELEPHONE CHANNEL	NUMBER OF POLES	TRENCH MILES	DUCT MILES
ALABAMA	0	1,539	9,010	4,434,826	437,664	1,236	9,302
ARIZONA	26	2,055	5,189	7,646,953	164,428	2,205	12,357
ARKANSAS	2	1,257	4,196	2,308,152	161,449	503	4,107
CALIFORNIA	2,322	4,564	11,864	5,486,759	1,777,519	26,449	130,474
COLORADO	127	2,109	7,091	9,997,258	207,211	2,481	13,849
CONNECTICUT	57	302	1,680	213,758	385,698	1,725	11,515
DELAWARE	73	0	0	0	45,038	400	2,897
DIST. OF COLUMBIA	3	0	0	0	17,410	591	4,006
FLORIDA	429	766	2,581	926,819	648,975	11,942	53,524
GEORGIA	351	79	144	110,069	428,041	2,948	23,258
HAWAII	403	2,269	4,323	1,802,361	143,044	619	1,571
IDAHO	42	1,771	3,833	3,066,866	59,832	413	2,595
ILLINOIS	528	878	11,737	675,380	732,259	6,644	43,504
INDIANA	225	331	139,442	244,841	489,301	3,509	16,955
IOWA	1,463	642	1,477	2,408,664	103,428	997	5,503
KANSAS	0	1,411	6,927	2,997,494	159,452	720	5,583
KENTUCKY	3	1,030	8,058	2,271,360	471,231	1,279	8,320
LOUISIANA	144	591	1,959	1,113,643	288,079	1,827	13,557
MAINE	61	685	1,498	437,631	240,065	466	2,315
MARYLAND	4	185	370	186,155	341,210	1,751	14,857
MASSACHUSETTS	108	260	1,214	485,146	645,720	5,343	30,588
MICHIGAN	32	1,344	3,759	2,262,467	650,329	5,374	34,400
MINNESOTA	446	445	910	1,189,514	143,436	2,027	12,440
MISSISSIPPI	39	743	2,204	878,160	262,687	471	3,919
MISSOURI	0	1,947	533,087	4,044,706	521,536	2,239	14,049
MONTANA	35	2,115	4,466	4,481,790	55,412	191	1,045
NEBRASKA	271	633	1,223	919,259	59,931	684	4,152
NEVADA	8	1,382	7,128	1,366,576	73,660	2,922	5,720
NEW HAMPSHIRE	24	640	2,275	253,424	217,179	552	3,446
NEW JERSEY	261	593	1,459	771,570	641,043	4,989	35,609
NEW MEXICO	43	1,397	3,393	5,310,825	84,633	666	3,212
NEW YORK	1,361	2,310	3,135,443	44,172,167	360,496	11,610	47,774
NORTH CAROLINA	574	127	254	218,958	471,069	2,094	14,879
NORTH DAKOTA	3	684	1,404	1,878,335	15,127	161	940
OHIO	43	912	315,259	694,101	1,197,207	5,301	33,898
OKLAHOMA	0	1,557	6,246	244,298	276,669	1,102	8,150
OREGON	1,615	2,189	5,295	5,172,467	163,578	1,564	8,358
PENNSYLVANIA	291	1,085	9,354	1,765,422	1,270,480	5,590	36,704
RHODE ISLAND	0	46	46	9,243	134,332	615	3,983
SOUTH CAROLINA	220	70	140	12,284	169,059	1,342	10,166
SOUTH DAKOTA	331	714	1,742	2,664,761	20,184	327	1,448
TENNESSEE	18	879	4,963	3,017,702	516,266	1,735	12,412
TEXAS	0	1,796	6,263	1,121,597	1,271,796	8,503	61,587
UTAH	90	1,532	3,234	3,567,212	85,813	766	4,377
VERMONT	8	59	235	124,515	141,693	303	1,322
VIRGINIA	10	888	11,545	1,532,671	534,895	2,926	16,548
WASHINGTON	426	1,707	5,295	6,801,999	300,902	2,816	15,149
WEST VIRGINIA	35	734	4,638	1,113,531	355,056	357	2,380
WISCONSIN	17	1,528	9,218	11,697,682	219,841	2,043	11,092
WYOMING	23	2,837	7,515	9,198,907	36,147	281	1,538
UNITED STATES	12,595	55,617	4,310,585	163,300,278	18,197,511	143,597	821,333
PUERTO RICO	46	992	1,135	1,193,662	228,777	0	3,155
OCEAN CABLE	911	0	0	0	0	0	0
GRAND TOTAL	13,552	56,609	4,311,720	164,493,940	18,426,288	143,597	824,488

Source: Federal Communications Commission

Table 12

Outside Plant Statistics of Reporting Local Exchange Companies as of December 31, 1990

	TOTAL EQUIPPED INTEROFFICE CIRCUIT MILES (CABLE AND MICROWAVE SYSTEMS)		
STATE	ANALOG 1/	DIGITAL 2/	VIDEO
ALABAMA	19,942	11,897,816	174
ARIZONA	2,100,235	3,903,846	0
ARKANSAS	284,399	3,812,608	0
CALIFORNIA	85,069	132,789,494	136
COLORADO	2,694,493	7,462,145	0
CONNECTICUT	438,053	6,816,493	110
DELAWARE	0	1,250,472	0
DIST. OF COLUMBIA	859	1,563,576	794
FLORIDA	433,118	52,506,791	25
GEORGIA	30,000	34,299,945	0
HAWAII	695,913	1,903,756	129
IDAHO	1,982,361	1,055,351	0
ILLINOIS	175,894	23,587,433	0
INDIANA	8,227	8,960,704	23
IOWA	249,982	4,024,954	0
KANSAS	104,565	9,534,271	0
KENTUCKY	3,149,658	10,629,297	176
LOUISIANA	4,822	7,268,607	19,530
MAINE	5,375	4,039,253	24
MARYLAND	10,070	7,542,288	189
MASSACHUSETTS	720	15,942,280	213
MICHIGAN	52,865	23,440,812	139
MINNESOTA	591,584	2,219,161	0
MISSISSIPPI	1,366,405	20,857,762	0
MISSOURI	423,313	9,926,390	0
MONTANA	2,019,536	976,413	0
NEBRASKA	1,107,442	5,781,085	152
NEVADA	678,115	3,235,876	56
NEW HAMPSHIRE	0	3,051,642	13
NEW JERSEY	0	14,225,496	326
NEW MEXICO	23,843	1,763,660	0
NEW YORK	97,460	116,449,104	4,281
NORTH CAROLINA	0	31,843,054	0
NORTH DAKOTA	1,221,329	319,312	0
OHIO	326,011	21,456,455	10
OKLAHOMA	471,891	4,533,546	0
OREGON	1,210,281	2,658,591	0
PENNSYLVANIA	554,433	16,458,540	71
RHODE ISLAND	0	965,279	0
SOUTH CAROLINA	0	7,897,331	0
SOUTH DAKOTA	289,176	454,858	0
TENNESSEE	78,967	14,780,925	460
TEXAS	657,802	28,786,463	0
UTAH	520,696	1,817,776	0
VERMONT	4,040	2,767,084	0
VIRGINIA	12,116	34,048,699	247
WASHINGTON	2,468,288	4,301,214	0
WEST VIRGINIA	26,964	2,479,937	0
WISCONSIN	29,837	10,247,625	111
WYOMING	2,755,259	518,989	0
UNITED STATES	29,461,409	739,054,459	27,389
PUERTO RICO	22,453	729,531	0
OCEAN CABLE	0	0	0
GRAND TOTAL	29,483,862	739,783,990	27,389

NOTE -- THIS TABLE EXCLUDES AT&T AND ALASCOM, WHICH HAD BEEN INCLUDED IN PRIOR YEARS.
-- SEE TABLE 2.10 FOR DATA OF INDIVIDUAL CARRIERS.
-- UNLESS OTHERWISE STATED, DATA INCLUDE LOCAL LOOP AND INTEROFFICE CIRCUIT.
-- STRAND INCLUDES WIRE AND FIBER.
-- NEW YORK TELEPHONE COMPANY, CONTEL OF ILLINOIS, CONTEL OF MISSOURI, AND THE GTE COMPANIES HAVE NO SYSTEM FOR TRACKING MILES OF EQUIPPED (LIT) FIBER.
-- WISCONSIN BELL INC. AND THE BELL ATLANTIC COMPANIES HAVE BEGUN ESTIMATING MILES OF EQUIPPED (LIT) FIBER.

1/ FIGURES SHOWN IN 4KHZ ANALOG EQUIVALENTS.

2/ FIGURES SHOWN IN 64KB DIGITAL (TIMES 24) EQUIVALENTS.

Table 13

Switched Access Lines by Type of Technology of Reporting Local Exchange Companies as of December 31, 1990

STATE	NO. OF CENTRAL OFFICE SWITCHES	ANALOG			DIGITAL			OTHER 5/	TOTAL SWITCHED ACCESS LINES
		MAIN ACCESS LINES 1/	PBX AND CENTREX TRUNKS	CENTREX EXTENSIONS	ISDN CONTROL 2/	MAIN ACCESS LINES 3/	PBX AND CENTREX TRUNKS 4/		
ALABAMA	200	1,499,136	43,024	30,385	149	1,192	15,936	46,891	1,636,713
ARIZONA	173	1,204,772	77,790	22	12	486,574	25,163	0	1,794,333
ARKANSAS	199	750,193	20,734	10,974	0	0	0	13,961	795,862
CALIFORNIA	1,197	15,673,392	602,056	967,097	1,885	525	165,696	153,009	17,563,660
COLORADO	222	1,284,412	95,816	0	346	446,549	31,360	0	1,858,483
CONNECTICUT	153	1,687,863	81,557	90,787	79	0	12,984	41,833	1,915,103
DELAWARE	36	350,997	12,935	41,137	0	0	0	15,031	420,100
DIST. OF COLUMBIA	40	430,380	55,098	154,312	589	4,716	168	193,637	838,900
FLORIDA	500	7,155,030	200,736	90,734	39	306	78,120	90,850	7,615,815
GEORGIA	286	2,665,798	109,233	88,118	255	2,040	54,576	108,261	3,028,281
HAWAII	90	530,705	18,965	21,390	0	0	0	524	571,584
IDAHO	118	334,282	14,873	0	0	88,353	5,405	27	442,940
ILLINOIS	866	5,457,293	242,735	313,112	1,077	52	1,488	143,305	6,159,062
INDIANA	545	2,149,440	56,430	193,636	210	420	8,400	0	2,408,536
IOWA	271	718,889	38,342	0	17	236,904	10,463	0	1,004,615
KANSAS	192	978,761	35,419	8,683	0	0	0	31,638	1,054,501
KENTUCKY	287	1,326,158	34,067	17,800	6	50	2,664	14,410	1,395,155
LOUISIANA	230	1,681,280	52,859	68,039	8	66	15,672	9,497	1,827,421
MAINE	142	533,633	12,180	20,576	0	0	1,248	0	567,637
MARYLAND	239	2,427,504	107,075	94,963	237	1,896	3,504	196,935	2,832,116
MASSACHUSETTS	286	3,288,468	168,056	159,769	8,171	11,602	6,912	0	3,642,978
MICHIGAN	637	4,266,408	141,832	83,963	31	246	0	225,746	4,718,226
MINNESOTA	207	985,480	110,474	0	1,113	593,302	83,474	0	1,773,843
MISSISSIPPI	205	905,233	19,851	20,853	1	12	4,632	24,392	974,974
MISSOURI	528	2,236,967	101,911	28,465	0	0	48	51,161	2,418,552
MONTANA	164	164,913	5,331	0	0	141,797	4,860	0	316,901
NEBRASKA	281	456,219	17,570	17,989	293	212,438	29,926	0	734,435
NEVADA	81	627,330	18,999	61,917	18	143	0	0	708,407
NEW HAMPSHIRE	121	561,533	16,158	19,146	0	0	312	0	597,149
NEW JERSEY	219	4,415,682	141,313	180,471	1,339	10,708	3,432	107,575	4,860,520
NEW MEXICO	81	350,887	24,410	164	0	235,347	18,058	60	628,926
NEW YORK	831	9,121,352	438,661	578,384	0	192,884	12,738	12,802	10,356,821
NORTH CAROLINA	403	2,624,533	74,639	57,056	17	129	15,648	64,900	2,836,922
NORTH DAKOTA	106	176,979	14,788	0	1	63,171	2,910	0	257,849
OHIO	843	4,605,032	165,434	228,464	5	790	1,776	1	5,001,502
OKLAHOMA	280	1,278,345	40,011	19,479	0	0	0	41,256	1,379,091
OREGON	166	934,808	59,504	0	81	286,839	23,070	30	1,304,332
PENNSYLVANIA	693	5,327,074	175,730	286,115	90	1,013	12,072	202,278	6,004,372
RHODE ISLAND	32	517,435	16,870	12,104	0	0	312	0	546,721
SOUTH CAROLINA	180	1,133,395	32,877	24,579	3	18	10,176	33,233	1,234,281
SOUTH DAKOTA	111	117,950	7,714	0	13	129,020	5,655	0	260,352
TENNESSEE	240	1,896,826	65,318	47,208	3	173,005	23,800	27,906	2,234,066
TEXAS	1,125	7,316,266	350,351	239,726	0	0	0	138,608	8,044,951
UTAH	101	499,832	42,273	0	1	169,798	10,628	0	722,532
VERMONT	91	253,721	6,263	9,685	0	0	456	0	270,125
VIRGINIA	454	2,810,446	119,018	192,816	382	58,683	4,152	108,134	3,293,631
WASHINGTON	258	1,365,454	93,668	17,132	2,479	819,770	119,001	19	2,417,523
WEST VIRGINIA	186	692,875	13,332	8,401	194	1,550	72	26,469	742,893
WISCONSIN	364	1,866,281	63,955	100,952	255	3,212	43,272	99	2,078,026
WYOMING	57	194,556	10,078	0	0	10,491	478	0	215,603
UNITED STATES	15,317	109,832,198	4,468,313	4,606,603	19,399	4,385,611	870,717	2,124,478	126,307,319
PUERTO RICO	163	870,803	0	0	0	0	0	0	870,803
GRAND TOTAL	15,480	110,703,001	4,468,313	4,606,603	19,399	4,385,611	870,717	2,124,478	127,178,122

NOTE -- SEE TABLE 2.10 FOR DATA OF INDIVIDUAL CARRIERS.

-- MICHIGAN BELL TELEPHONE COMPANY HAS NO SYSTEM FOR TRACKING ANALOG VERSUS DIGITAL TRUNKS.

-- BELL ATLANTIC D CHANNELS ARE COUNTED AS ACCESS LINES IN THIS TABLE. THE BELL ATLANTIC COMPANIES HAVE BEGUN REPORTING DIGITAL CENTREX EXTENSIONS AS OTHER SWITCHED ACCESS LINES. IN PREVIOUS YEARS, THEY HAD INCLUDED ANALOG AND DIGITAL CENTREX EXTENSIONS WITH MAIN ANALOG ACCESS LINES.

-- THE SOUTHERN NEW ENGLAND TELEPHONE COMPANY AND UNITED INTER-MOUNTAIN TELEPHONE COMPANY EXCLUDED COMPANY OFFICIAL ACCESS LINES, WHICH HAD BEEN INCLUDED IN PRIOR YEARS.

-- PUERTO RICO TELEPHONE COMPANY WAS UNABLE TO PROVIDE ACCESS LINES BY TECHNOLOGY. WE INCLUDED ALL SWITCHED ACCESS LINES (870,803) WITH MAIN ANALOG ACCESS LINES.

1/ 4KHZ-OR EQUIVALENT.
2/ ISDN 16 KB/SEC D CHANNELS (DIVIDED BY 4).
3/ 64 KB/SEC OR EQUIVALENT (ISDN B CHANNELS, EXCEPT TO PBX'S).
4/ DIGITAL DS-1 ACCESS LINES TO PBX'S AND CENTREX (TIMES 24).
5/ INCLUDES DIGITAL CENTREX EXTENSIONS.

Source: Federal Communications Commission

Table 14

Access Lines by Type of Customer of Reporting Local Exchange Companies as of December 31, 1990

STATE	BUSINESS ACCESS LINES		PUBLIC ACCESS LINES	RESIDENTIAL ACCESS LINES	MOBILE ACCESS LINES	TOTAL SWITCHED ACCESS LINES	SPECIAL ACCESS LINES (NON-SWITCHED)	TOTAL ACCESS LINES (SWITCHED & SPECIAL)
	SINGLE-LINE	MULTI-LINE						
ALABAMA	42,657	342,228	20,033	1,231,659	136	1,636,713	18,384	1,655,097
ARIZONA	43,582	406,103	25,157	1,318,625	866	1,794,333	135,707	1,930,040
ARKANSAS	30,588	140,540	14,534	609,907	293	795,862	6,737	802,599
CALIFORNIA	3,267,686	2,371,837	197,477	11,369,341	2,391	17,208,732	762,617	17,971,349
COLORADO	56,781	461,246	23,836	1,315,733	887	1,858,483	236,953	2,095,436
CONNECTICUT	61,612	482,170	27,191	1,344,120	10	1,915,103	1,235	1,916,338
DELAWARE	58,509	79,046	5,710	276,641	194	420,100	7,408	427,508
DIST. OF COLUMBIA	132,832	409,278	11,147	285,564	79	838,900	15,128	854,028
FLORIDA	398,804	1,580,006	80,692	5,555,435	878	7,615,815	119,092	7,734,907
GEORGIA	106,097	831,223	39,577	2,051,293	91	3,028,281	51,243	3,079,524
HAWAII	20,602	145,546	7,726	397,186	524	571,584	9,088	580,672
IDAHO	18,382	82,945	5,691	335,665	257	442,940	17,045	459,985
ILLINOIS	1,083,416	858,689	88,860	4,127,836	261	6,159,062	83,842	6,242,904
INDIANA	265,707	338,421	34,286	1,770,122	0	2,408,536	239,698	2,648,234
IOWA	36,158	191,881	10,489	766,087	0	1,004,615	78,267	1,082,882
KANSAS	34,763	228,119	15,994	774,999	626	1,054,501	18,596	1,073,097
KENTUCKY	50,428	242,912	18,761	1,082,743	311	1,395,155	24,480	1,419,635
LOUISIANA	46,960	390,049	23,047	1,367,052	313	1,827,421	18,279	1,845,700
MAINE	131,800	0	7,083	428,754	0	567,637	3,754	571,391
MARYLAND	492,956	414,382	42,155	1,882,479	142	2,832,114	49,730	2,881,844
MASSACHUSETTS	1,068,579	0	55,143	2,519,256	0	3,642,978	32,272	3,675,250
MICHIGAN	763,838	539,133	63,448	3,350,927	880	4,718,226	72,916	4,791,142
MINNESOTA	43,101	466,757	15,569	1,248,415	1	1,773,843	201,269	1,975,112
MISSISSIPPI	33,473	183,840	15,141	742,473	47	974,974	8,920	983,894
MISSOURI	82,797	484,866	39,029	1,811,449	411	2,418,552	21,076	2,439,628
MONTANA	14,229	57,393	5,027	240,022	230	316,901	14,126	331,027
NEBRASKA	40,325	154,010	8,741	528,466	2,893	734,435	185,759	920,194
NEVADA	50,214	151,075	11,515	495,062	541	708,407	43,217	751,624
NEW HAMPSHIRE	161,122	0	8,417	427,610	0	597,149	4,581	601,730
NEW JERSEY	1,005,919	486,302	90,002	3,278,122	175	4,860,520	82,971	4,943,491
NEW MEXICO	20,580	134,297	8,490	465,499	60	628,926	31,603	660,529
NEW YORK	2,222,231	1,023,044	129,861	6,974,190	1,238	10,350,564	175,518	10,526,082
NORTH CAROLINA	156,531	572,393	31,126	2,076,336	536	2,836,922	48,448	2,885,370
NORTH DAKOTA	10,293	53,952	3,154	190,322	128	257,849	24,404	282,253
OHIO	607,353	594,661	68,049	3,731,148	291	5,001,502	193,759	5,195,261
OKLAHOMA	48,069	280,340	23,052	1,026,464	1,166	1,379,091	8,805	1,387,896
OREGON	46,070	280,313	17,122	960,350	477	1,304,332	132,429	1,436,761
PENNSYLVANIA	935,143	806,919	84,200	4,176,974	1,136	6,004,372	157,175	6,161,547
RHODE ISLAND	130,400	0	7,418	408,903	0	546,721	3,781	550,502
SOUTH CAROLINA	49,693	260,110	18,474	906,004	0	1,234,281	17,251	1,251,532
SOUTH DAKOTA	11,497	50,847	3,650	194,356	2	260,352	13,959	274,311
TENNESSEE	69,083	475,225	24,815	1,664,607	336	2,234,066	27,622	2,261,688
TEXAS	239,432	1,937,604	112,459	5,752,288	3,168	8,044,951	66,027	8,110,978
UTAH	20,560	165,379	8,739	527,551	303	722,532	159,233	881,765
VERMONT	67,021	0	4,204	198,900	0	270,125	2,748	272,873
VIRGINIA	529,793	475,777	48,104	2,239,660	297	3,293,631	163,519	3,457,150
WASHINGTON	73,312	578,697	27,539	1,737,613	362	2,417,523	162,547	2,580,070
WEST VIRGINIA	97,437	57,286	12,007	576,131	32	742,893	25,229	768,122
WISCONSIN	270,016	257,062	29,307	1,521,542	99	2,078,026	19,531	2,097,557
WYOMING	10,478	45,963	3,947	154,549	666	215,603	10,937	226,540
UNITED STATES	15,258,909	20,569,866	1,677,195	88,416,430	23,734	125,946,134	4,008,915	129,955,049
PUERTO RICO	156,704	35,439	17,380	640,911	20,369	870,803	3,475	874,278
GRAND TOTAL	15,415,613	20,605,305	1,694,575	89,057,341	44,103	126,816,937	4,012,390	130,829,327

NOTE -- SEE TABLE 2.10 FOR DATA OF INDIVIDUAL CARRIERS.

-- BELL ATLANTIC D CHANNELS ARE COUNTED AS MULTI-LINE BUSINESS ACCESS LINES IN THIS TABLE.

-- SOUTH CENTRAL BELL TELEPHONE COMPANY AND SOUTHERN BELL TELEPHONE & TELEGRAPH COMPANY EXCLUDED ISDN D CHANNELS, MAIN DIGITAL ACCESS LINES, AND DIGITAL PBX AND CENTREX TRUNKS. WE INCLUDED THEM (60,741 AND 159,363 RESPECTIVELY) WITH MULTI-LINE BUSINESS ACCESS LINES.

-- NEW ENGLAND TELEPHONE COMPANY WAS UNABLE TO SEPARATE BUSINESS ACCESS LINES BETWEEN SINGLE AND MULTI-LINE.

-- THE SOUTHERN NEW ENGLAND TELEPHONE COMPANY AND UNITED INTER-MOUNTAIN TELEPHONE COMPANY EXCLUDED COMPANY OFFICIAL ACCESS LINES, WHICH HAD BEEN INCLUDED IN PRIOR YEARS.

Source: Federal Communications Commission

Table 15

Telephone Calls and Minutes of Reporting Local Exchange Companies as of December 31, 1990

			INTERLATA TOLL CALLS (COMPLETED)					
			INTERSTATE		INTRASTATE		TOTAL INTERLATA TOLL CALLS	
STATE	TOTAL LOCAL CALLS	INTRALATA TOLL CALLS (COMPLETED)	NUMBER	BILLED ACCESS MINUTES	NUMBER	BILLED ACCESS MINUTES	NUMBER	BILLED ACCESS MINUTES
ALABAMA	6,759,815	144,815	325,213	3,779,292	122,834	1,153,106	448,047	4,932,398
ARIZONA	6,268,036	97,539	525,724	5,483,233	72,253	672,678	597,977	6,155,911
ARKANSAS	2,793,173	122,889	188,523	1,979,375	55,653	473,420	244,176	2,452,795
CALIFORNIA	48,967,177	6,157,908	2,364,226	29,532,017	2,308,827	20,739,137	4,673,053	50,271,154
COLORADO	6,422,190	140,799	504,091	5,630,752	62,636	675,743	566,728	6,306,495
CONNECTICUT	5,218,859	672,437	832,502	3,203,534	406	1,441	832,908	3,204,975
DELAWARE	1,181,418	52,868	117,786	1,211,214	0	0	117,786	1,211,214
DIST. OF COLUMBIA	3,172,295	2,898	194,099	2,476,843	0	0	194,099	2,476,843
FLORIDA	23,818,732	678,596	1,581,088	18,446,344	700,104	6,122,919	2,281,192	24,569,264
GEORGIA	12,610,429	290,903	757,629	8,586,783	160,703	1,643,829	918,332	10,230,612
HAWAII	2,496,042	33,538	53,654	1,319,461	0	0	53,654	1,319,461
IDAHO	1,202,190	65,451	116,393	1,303,360	11,052	131,096	127,445	1,434,456
ILLINOIS	19,110,916	616,497	3,156,509	14,346,137	809,337	4,317,137	3,965,846	18,663,274
INDIANA	7,700,830	289,050	946,807	5,338,701	357,615	2,090,071	1,304,421	7,428,773
IOWA	2,942,929	129,609	226,308	2,413,086	80,700	945,454	307,008	3,358,540
KANSAS	3,494,595	107,352	275,553	2,715,797	73,146	735,697	348,699	3,451,494
KENTUCKY	5,182,031	158,487	249,090	3,001,997	70,572	770,803	319,663	3,772,800
LOUISIANA	8,531,534	185,591	395,199	4,140,030	147,352	1,304,246	542,552	5,444,277
MAINE	1,189,521	124,336	317,826	1,275,754	4,220	16,938	322,046	1,292,692
MARYLAND	10,196,825	98,599	605,718	7,047,281	182,819	1,945,972	788,537	8,993,253
MASSACHUSETTS	10,887,773	862,042	2,097,428	9,646,071	164,529	756,670	2,261,957	10,402,741
MICHIGAN	16,745,895	1,154,594	1,660,517	8,350,986	790,285	3,970,408	2,450,802	12,321,394
MINNESOTA	6,094,566	91,506	357,107	3,941,495	117,097	1,273,637	474,204	5,215,132
MISSISSIPPI	4,105,413	144,097	206,761	2,497,635	31,188	266,609	237,949	2,764,244
MISSOURI	8,945,420	313,978	516,907	5,269,787	121,157	1,128,286	638,063	6,398,073
MONTANA	820,971	41,438	74,693	851,826	21,158	228,099	95,851	1,079,925
NEBRASKA	2,272,366	64,927	174,896	1,531,557	61,847	435,032	236,743	1,966,589
NEVADA	2,315,260	30,674	219,640	1,466,115	13,001	81,625	232,641	1,547,741
NEW HAMPSHIRE	1,485,501	134,837	518,625	2,114,436	362	1,474	518,987	2,115,910
NEW JERSEY	11,773,570	2,023,652	1,548,578	15,663,823	334,334	3,134,517	1,882,912	18,798,340
NEW MEXICO	2,176,529	76,756	164,105	1,826,454	4,134	42,254	168,239	1,868,708
NEW YORK	21,391,503	579,223	2,671,322	14,773,591	591,520	3,591,784	3,262,842	18,365,376
NORTH CAROLINA	8,649,193	310,921	562,039	6,743,212	338,144	3,295,884	900,183	10,039,096
NORTH DAKOTA	695,455	30,770	53,836	564,180	13,593	130,795	67,430	694,975
OHIO	17,174,645	432,504	1,858,240	9,609,989	971,639	5,082,029	2,829,879	14,692,018
OKLAHOMA	4,803,588	189,017	312,712	3,282,545	63,764	662,194	376,477	3,944,739
OREGON	3,806,399	211,319	261,062	3,197,707	76,831	872,068	337,893	4,069,775
PENNSYLVANIA	17,495,758	930,036	1,300,561	12,624,975	320,664	3,585,827	1,621,225	16,210,801
RHODE ISLAND	1,509,190	56,706	442,431	1,652,480	221	825	442,652	1,653,305
SOUTH CAROLINA	4,793,572	117,594	273,448	3,343,831	100,661	981,113	374,109	4,324,944
SOUTH DAKOTA	729,473	39,314	61,335	711,371	6,824	49,968	68,160	761,339
TENNESSEE	9,287,362	224,959	497,533	5,452,134	125,755	1,158,427	623,288	6,610,560
TEXAS	32,361,264	693,426	1,476,474	16,132,566	879,583	9,229,032	2,356,057	25,361,598
UTAH	2,877,533	93,109	177,791	1,873,813	9,793	75,135	187,585	1,948,948
VERMONT	534,063	45,669	198,098	873,610	3,806	16,787	201,904	890,397
VIRGINIA	10,925,588	212,171	783,425	8,503,024	284,622	2,775,654	1,068,048	11,278,678
WASHINGTON	7,588,892	420,868	437,346	5,432,632	100,627	1,346,328	537,973	6,778,960
WEST VIRGINIA	2,405,681	71,013	143,990	1,728,745	27,587	322,352	171,577	2,051,097
WISCONSIN	5,881,781	287,152	898,268	4,534,835	332,857	1,748,758	1,231,126	6,283,593
WYOMING	543,286	30,939	64,631	708,901	2,192	21,016	66,823	729,917
UNITED STATES	400,337,030	20,085,374	33,747,738	278,135,318	11,130,006	90,004,273	44,877,744	368,139,591
PUERTO RICO	2,155,262	178,180	42,349	389,038	182,790	807,571	225,139	1,196,609
GRAND TOTAL	402,492,293	20,263,554	33,790,087	278,524,356	11,312,796	90,811,844	45,102,883	369,336,200

NOTE -- THIS TABLE EXCLUDES AT&T AND ALASCOM, WHICH HAD BEEN INCLUDED IN PRIOR YEARS.

-- SEE TABLE 2.10 FOR DATA OF INDIVIDUAL CARRIERS.

-- THE NUMBER OF TOLL CALLS IS BASED ON ORIGINATING MESSAGE VOLUMES.

-- BILLED ACCESS MINUTES ARE BASED ON BILLS SENT TO CUSTOMERS (INTEREXCHANGE CARRIERS) AND INCLUDE TOTAL ORIGINATING AND TERMINATING ACCESS MINUTES OF USE. BECAUSE BILLED ACCESS MINUTES WERE NOT AVAILABLE, UNITED INTER-MOUNTAIN TELEPHONE COMPANY REPORTED EARNED MINUTES.

Source: Federal Communications Commission

INTEREXCHANGE MARKET

INTEREXCHANGE MARKET

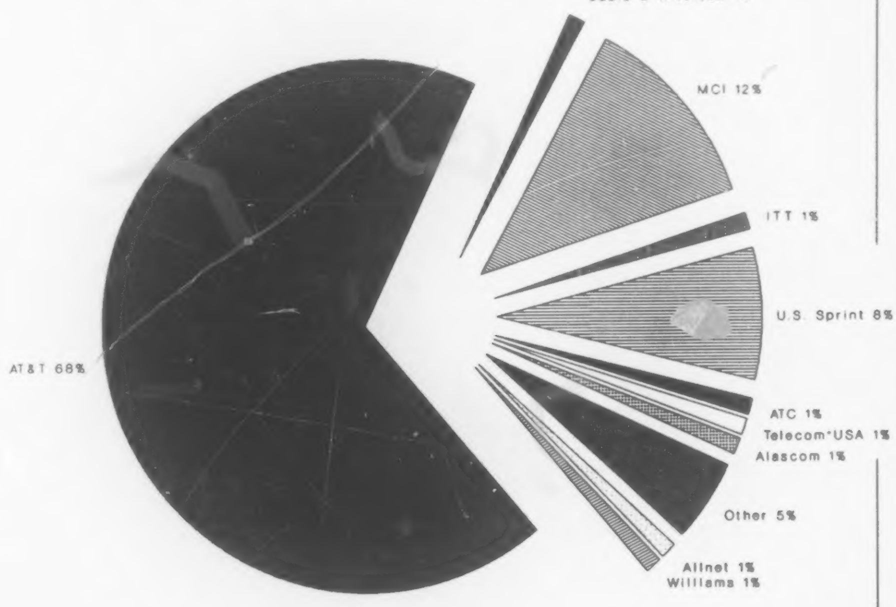
The market for long distance (interLATA) services has been radically changed by competition. Until 1969, AT&T was the only long distance carrier. In that year, the FCC authorized MCI to provide specialized long distance service. Since then, over 500 companies have sprung up to provide private and/or common-carrier interexchange voice and/or data services. Most of these companies resell capacity of larger carriers and serve small niche markets. Although the market for international long distance is large and growing, this study concentrates on domestic interLATA service.

The interexchange market has spurred significant development in transmission media, including satellite, microwave, and fiber optics. The thrust of these technologies has been to increase the capacity and cost efficiencies of the networks, allowing carriers to become more competitive in the marketplace. Consumers have benefitted greatly from these initiatives as average long distance rates have plummeted.

The total value of the long distance market has increased from $32.5 billion in 1985 to $52.1 billion in 1990 (Table 17, page 64). Three carriers — AT&T, MCI, and US Sprint — hold almost 90 percent of the market (Fig. 13). The total number of long distance (intraLATA and interLATA) calls completed in 1990 amounted to some 67 billion. AT&T

Figure 13

1990 Long Distance Market by Carrier



Source: NATA Market Research Department

1990 Market = $52.1 Billion

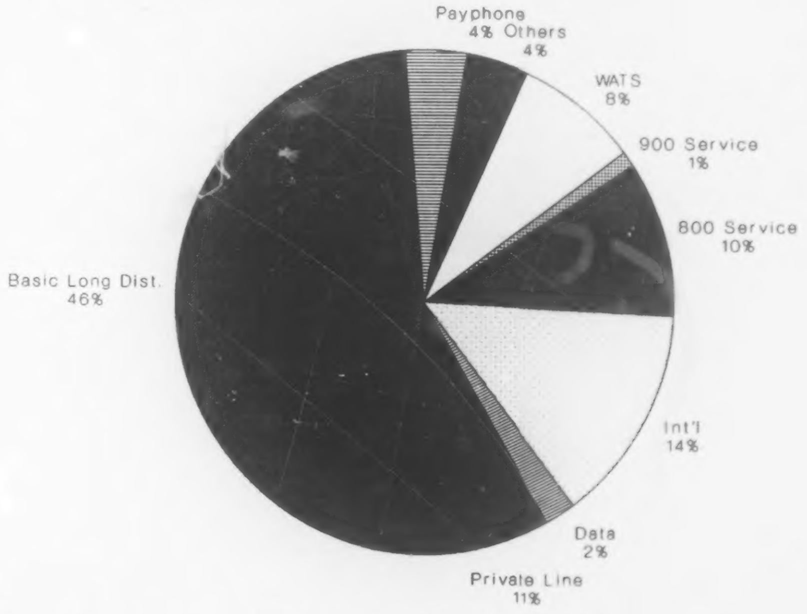
Communications, by far the largest long distance (interLATA) carrier, had long distance revenues of $35.0 billion in 1990, up slightly from $34.6 billion in 1989. AT&T's share of the total market has decreased from 68 percent in 1989 to 67.2 percent in 1990. MCI, the second largest long distance carrier, had revenues of $6.7 billion in 1990, up from $6.2 billion in 1989. MCI's share of the market has edged up from 12.2 percent in 1989 to 12.9 percent in 1990. US Sprint's long distance revenue increased from $4.3 billion in 1989 to $4.4 billion in 1990 (8.4 percent of the total each year). Other carriers such as Telesphere, Cable and Wireless, and Allnet are beginning to gain on the leaders as they offer advanced voice and data services in niche markets.

According to a study sponsored by The Competitive Telecommunications Association (CompTel), long distance carriers showed an aggregate $1 billion loss in 1987, but reversed that loss in 1988 to achieve a $2 billion profit. Lower tier carriers (those with less than $1 billion in revenue) experienced 45 percent revenue growth, compared to 12 percent for the big three — AT&T, MCI, and US Sprint. Increased revenues from business customers contributed heavily to overall revenue growth. Revenue per business customer increased 5.5 percent.

The CompTel study also detailed carrier costs. Of $51.7 billion in revenue in 1988, 37 percent went to access charges, 29 percent to facilities, 10 percent to general and administrative expenses, 9 percent to operations and maintenance, 8 percent to sales and advertising, 6 percent to depreciation and amortization, and the balance to other miscellaneous items (including profit).

Figure 14

1990 Long Distance Market by Type of Service



Source: NATA Market Research Department

1990 Market = $52.1 Billion

A significant consolidation is underway in the long distance market, as small regional companies acquire or merge with one another or form consortia. For instance, Telecom* USA, the result of a recent merger between two regional carriers — SouthernNet and Teleconnect — was acquired by MCI in 1990. Advanced Telecommunications of Atlanta has been actively acquiring regional carriers. (National Telecommunications Network (NTN) and National Switch Network (NSN) are two consortia (with some shared members) formed to enhance the existing capabilities of their members. NTN was established to offer nationwide private line capacity and facilities resale capabilities, and NSN was created to share switch and fiber facilities.

By the end of 1989, 2.2 million route miles of fiber optics had been laid by long distance carriers. This growth will abate slightly in the near future as most facilities-based carriers complete their fiber networks. AT&T completed its $6 billion, two-year network upgrade begun in 1987. By the end of 1990, AT&T's network was 100 percent digital, with 24,000 miles of fiber optic cables and 53,000 miles of digital network coverage.

These fiber networks have been constructed not only to increase the speed and efficiency of the network, but also to expand the capacity of the network to offer advanced services. In fact, while basic long distance service continues to dominate and account for almost half of the long distance market (Fig. 14, page 62), much of the current 14 percent average annual growth in the market is in advanced services such as 800, 900, and data transmission (Table 17, page 64).

The market for 900 services, currently offered by AT&T, MCI, US Sprint, and Telesphere, is expected to grow from $500 million in 1989 to $4 to $5 billion by 1995. Growth in 900 services will come mainly at the expense of growth in 800 services (toll-free long distance), which should remain relatively stable through the next several years. As remote data processing becomes ubiquitous, as with point of sale terminals, automatic teller machines, credit card validation terminals, etc., data transmission services are likely to grow from $800 million in 1988 to $5 to $6 billion by 1995.

Table 16

Interexchange Revenues* and Market Shares of Major Service Providers, 1985-1990

	1985	1986	1987	1988	1989	1990
	billions of dollars					
AT&T	27.5	32.3	35.2	35.4	34.6	35.0
MCI	2.5	3.6	3.9	4.9	6.2	6.7**
U.S. Sprint	1.2	2.6	2.8	3.4	4.3	4.4
Others	1.3	2.9	3.3	3.2	5.8	6.0
Total	32.5	41.4	45.2	46.9	50.9	52.1
	percent of total					
AT&T	84.6	78.1	77.9	75.5	68.0	67.2
MCI	7.6	8.7	8.6	10.4	12.2	12.9
U.S. Sprint	3.6	6.2	6.2	7.2	8.4	8.4
Others	4.1	7.0	7.3	6.9	11.4	11.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Excludes Local Exchange Carriers

** Excludes Telecom-USA

Source: NATA Market Research Department

Table 17

1989 Long Distance Market by Industry Segment

Industry Segment	Industry Revenues ($ Bil.)	Estimated 1989-1995 CAGR* (%)	1989 Market Share (%)			
			AT&T	MCI	Sprint	Other
Basic Long Distance	24.4	10	65	16	11	8
International	6.7	20	80	12	8	0
Private Line	5.6	15	87	8	4	1
800	5.0	10	80	15	4	1
WATS	4.1	9	70	15	10	5
Payphone	2.0	10	80	8	7	5
Data	1.0	22	89	7	3	1
900	1.0	30	88	2	4	6
Other	1.5	N/A	N/A	N/A	N/A	N/A
Total	50.9	N/A	68	12	8	12

* Compound Annual Growth Rate

Source: NATA Market Research Department

NETWORK EQUIPMENT MARKET

NETWORK EQUIPMENT MARKET

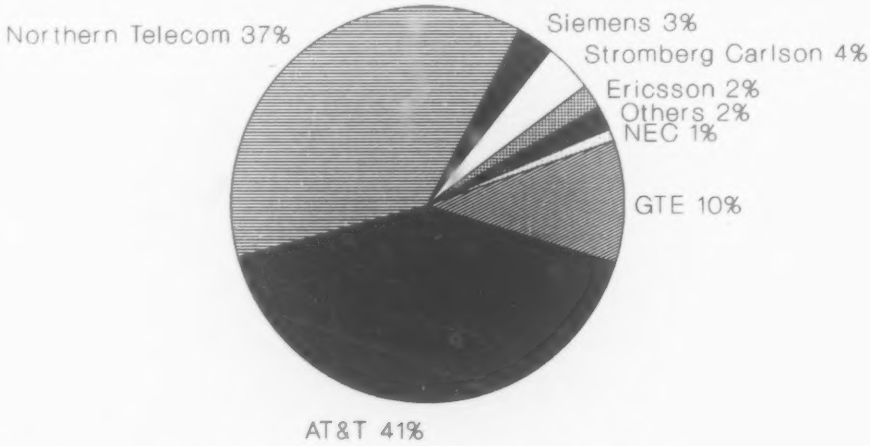
The network equipment market consists principally of telecommunications equipment used by common carriers to provide telecommunications services. (For more information on common carriers, see the section on telecommunications services market.) The public telecommunications network consists of some 25,000 telephone central office installations and more than 3 billion circuit miles of transmission capacity. Typically, switching equipment represents approximately 50 percent of total telephone industry investment. The national common carrier network constitutes a capital investment exceeding $250 billion.

In terms of value, the principal equipment categories include central office switches, fiber optic cables and associated electronics, and outside plant. Other important equipment categories include various types of transmission equipment, data communications equipment (see section on data communications equipment, page 125), and mobile communications equipment (see section on mobile communications, page 157).

The nctwork equipment market grew rapidly from $5.0 billion in 1984 to $9.5 billion in 1990, as long distance carriers upgraded their networks with fiber optics (Table 18, page 70). In addition, local carriers have been completing the changeout of their

Figure 15

1990 CO Switch Market by Manufacturer



1990 Total Market = $5.0 Billion

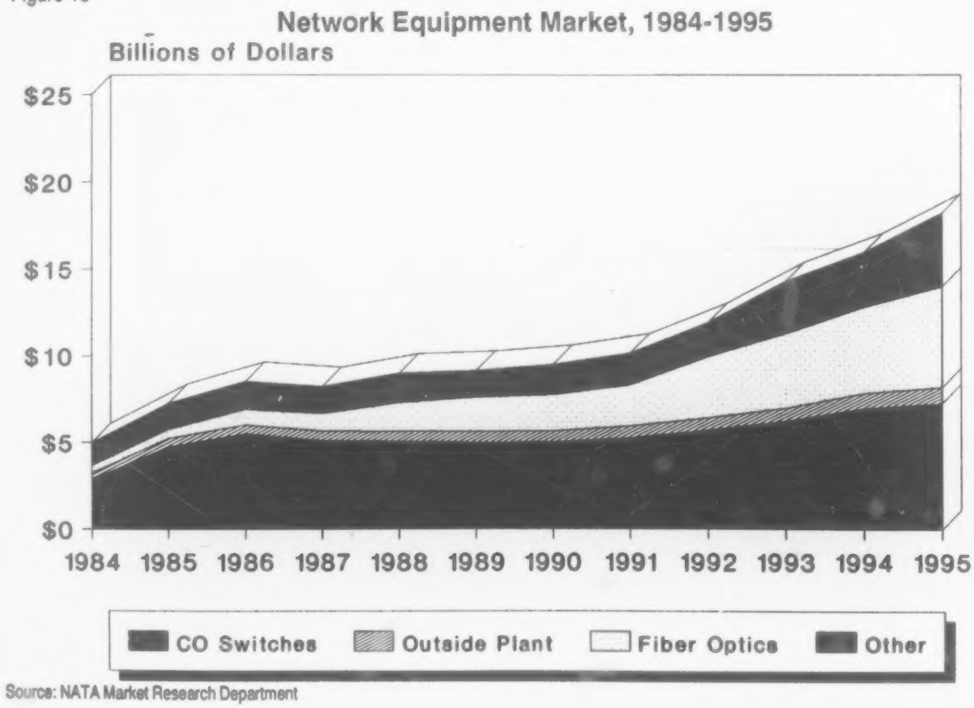
Source: NATA Market Research Department

electromechanical switches to electronic switches. In fact, many of the local exchange companies have begun the conversion of their switches to digital in anticipation of ISDN and various advanced services requiring digital switching capability. The number of digital switches installed increased from about 900 in 1985 to an estimated 4000 in 1990. In addition, despite the fact that new switches being sold are predominantly digital, the market for expansions and upgrades of existing analog switches remains relatively strong.

The largest segment of the network equipment market is represented by the market for CO switches, which grew from $2.9 billion in 1984 to $5.5 billion in 1986 before decreasing to $5.0 billion in 1989 and 1990. The two largest suppliers of CO switches in the marketplace are AT&T and Northern Telecom (Fig. 15, page 67). Northern Telecom is a Canadian-based subsidiary of Bell Canada, the dominant local exchange company in Canada. Northern Telecom has many years of experience producing switches for the Canadian network, which is virtually identical technologically to the U.S. network.

Northern Telecom has been rapidly increasing its share of the CO switch market at the expense of AT&T. Sales of Northern Telecom's switches increased by a compound annual growth rate of 19.5 percent during the period 1984 to 1990, while AT&T switch sales have remained fairly flat. Reasons for this vary, but include the RBOCs' assertion of their independence from AT&T since divestiture by turning to Northern Telecom. In addition, there have been some complaints that AT&T has purposely kept the centrex feature capability of its CO switches at a minimum level to reduce competition with its PBXs.

Figure 16



Source: NATA Market Research Department

AT&T has not sat idly by watching its RBOC market share slip. In mid 1988, AT&T and GTE signed an agreement whereby AT&T would gradually take over GTE's CO switch business. Considering that GTE is the largest single independent local exchange company in the United States and that GTE's share of the total CO business in 1990 was 10 percent, the agreement represents an aggressive move on the part of AT&T to maintain, and even increase, its total share of the CO switch marketplace.

Other companies that have had some success at selling switches have been Stromberg Carlson, Siemens, Ericsson, and NEC. (In late 1990, Siemens and Stromberg Carlson merged their U.S. CO switch operations.) These companies have tried for several years to crack the RBOC market, but for the most part have been excluded from large switch orders. What keeps these companies in the marketplace is the anticipation of possible orders in the next big wave of switch changeout, which is likely to begin accelerating between 1992 and 1995 as the RBOCs replace about 60 million analog and exchange access lines (about 55 percent of the total) with digital lines. While this changeout will provide tremendous opportunities for switch manufacturers, the profitability of the sales is likely to decrease. Prices for CO switches have been on a downward trend for the past few years and are not likely to increase significantly in the near future as competition for RBOC business intensifies.

Table 18

Network Equipment Market,* 1984-1995

(millions of dollars)

	1984	1985	1986	1987	1988	1989	1984-95 CAGR** (Percent)
Central Office Switches	2,900	4,750	5,500	5,100	5,050	4,975	11.4
Fiber Optics	410	500	883	1,011	1,650	1,990	37.2
Outside Plant	350	475	500	550	575	610	11.8
Other	1,320	1,510	1,630	1,550	1,680	1,520	2.9
Total	4,980	7,235	8,513	8,211	8,955	9,095	12.8

	1990	(p) 1991	(p) 1992	(p) 1993	(p) 1994	(p) 1995	1990-95 CAGR** (Percent)
Central Office Switches	5,010	5,250	5,686	6,210	6,965	7,250	7.7
Fiber Optics	2,075	2,375	3,520	4,300	4,950	5,810	22.9
Outside Plant	615	652	683	715	845	900	7.9
Other	1,755	1,825	1,976	3,022	3,155	4,233	19.3
Total	9,455	10,102	11,865	14,247	15,915	18,193	14.0

* Does not include cellular network equipment

** Compound Annual Growth Rate

(p) Projection

Source: NATA Market Research Department

CUSTOMER PREMISES EQUIPMENT OVERVIEW

CUSTOMER PREMISES EQUIPMENT OVERVIEW

Overview

The principal types of customer premises equipment (CPE) addressed in this report include PBXs, key/hybrid systems, facsimile terminals, voice/call processing equipment, data communications equipment, residential telecommunications products, payphones, and videoconferencing equipment. The markets for these products, which are sometimes also referred to as terminal equipment, represent at least half the entire telecommunications equipment marketplace. The bulk of this equipment is used by businesses for internal and external communications. Businesses have come to understand the significant role communications plays in productivity, efficiency, and profitability. Increasingly, communications capabilities are viewed as strategic assets and as such are given strategic goals of increasing revenue and decreasing costs. To achieve those ends, business users are becoming more sophisticated and proactive in the demands they make on suppliers of equipment and services. In filling these demands, equipment vendors face both challenges and opportunities.

The various CPE markets, while related, are quite separate in terms of market trends, technologies, and distribution channels. While many of the markets for the different types of CPE are addressed separately, there are some facets of the CPE marketplace that affect a variety of products. Included are the implications of ISDN, the role of systems integration in the marketplace, the growth of the used equipment market (typically called the secondary equipment market), and the development of the market for CPE used in conjunction with centrex services.

CPE Purchaser Profile

Businesses have increasingly looked to the telecommunications industry to provide products which enhance business productivity. Business telecommunications purchasers' common investments in new equipment include facsimile terminals, PBXs, headsets, power protection devices, key systems, call accounting, paging, LANs, voice mail, T-1 equipment, cellular phones, ACDs, and automated attendants.

When asked what CPE products they would purchase in 1990, 35 percent of the businesses responding indicated they would buy facsimile terminals, 30 percent said they would purchase voice mail, 27 percent headsets, 25 percent PBXs, 22 percent automated attendants, 22 percent call accounting, 21 percent key systems, 19 percent LANs, 18 percent power protection devices, 17 percent cellular, and 16 percent ACDs. Other products likely to see significant growth in demand include videoconferencing, voice response units, telemanagement software, and T-1 equipment. These are clearly the types of equipment on which CPE vendors should be concentrating.

ISDN

The implementation of ISDN will undoubtedly have a significant impact on the CPE marketplace. If telcos deploy and price ISDN aggressively, business users will begin to make buying decisions that will stimulate the market for many types of ISDN CPE, potentially depressing the market for other products. Overall, the ISDN CPE market is expected to grow to over $5.0 billion by 1995. The products sold in an ISDN environment include terminal adapters, voice/data/video terminals, PBXs, key systems, multiplexers, local area network bridges, and Group 4 facsimile terminals.

Terminal adapters allow ISDN connectivity with non-ISDN user equipment. These products ease the transition to ISDN and protect the installed base from instant obsolescence. Terminal adaptors currently represent the largest selling segment of ISDN CPE. The market for these products, however, will peak early as ISDN terminals become commonplace.

The market for PBXs in an ISDN environment is difficult to predict. So far, the RBOCs have been promoting the basic-rate interface (BRI) for ISDN (144 kilobits per second for two "bearer" channels and one signalling channel). BRI is typically used to connect terminal equipment directly to the network. Bellcore and the RBOCs have published some standards for this technology and have incorporated it into their ISDN trials. With BRI, the RBOCs have positioned digital centrex as a seamless gateway to ISDN. This frustrates PBX vendors, who typically rely on the primary-rate interface (PRI) for connecting PBXs with other PBXs and with the network (1.544 mbps for 23 bearer channels and one data channel). Virtually all major PBX manufacturers have recently announced PBX products with PRI capability. As with the current competitive battle between PBXs and centrex, users will be forced to choose between CO-based ISDN centrex services and PBX-based ISDN capability. The battle will be hard fought, and the RBOCs have a slight head start. AT&T and other interexchange carriers are incorporating PRI in long distance ISDN trials. It is a bit too early to predict the outcome. If Bellcore and the RBOCs extend their standards work to include PRI as well as BRI, an optimistic forecast would put the market for PBXs with PRI capability at $3.0 billion by 1995.

The market for digital ISDN-compatible key systems is likely to be stimulated by implementation of ISDN. For the same reasons that CO-based ISDN centrex will have a moderating effect on the demand for PBXs, ISDN centrex will stimulate the demand for key systems. As ISDN centrex increases its share of the business market, key systems will become important adjunct equipment, giving the user increased functionality and flexibility. The market for adjunct key systems to be used with CO-based centrex ISDN should experience strong growth and amount to about $50 million by 1995. Bellcore predicts the user profile for BRI will move from almost exclusive centrex deployment into a nearly even mix among business lines (non-PBX, non-centrex), residential (including offices in the home), and centrex by 1995.

More than any other segment of the CPE business, the data communications equipment market is likely to experience the most change as ISDN is implemented. Specifically, low-end LANs will likely be displaced by CO-based LANs as the data handling capability of CO switches is enhanced through digital architecture. The market for modems will decline as end-to-end digital connectivity obviates their use. The market for separate packet switching equipment will decrease as digital CO switches assume much of the packet switching requirements of the public network. New and growing data communications markets include LAN-ISDN gateways and terminal adapters. In addition, when PRI applications begin to proliferate, the market for multiplexers will accelerate.

One CPE market likely to explode is the market for Group 4 fax terminals. These terminals will bring a new level of utility to facsimile transmission, with their expanded capabilities include high transmission speed (about five seconds per page) and resolution high enough to use faxed copies as original documents.

Systems Integration

Systems integration can be defined as the combining of hardware, software, and communications within a total package. Systems integration is the sale of applications-oriented solutions to meet a customer's specific telecommunications/data communications needs. Some products typically offered by systems integrators as part of their packaged solutions include PBXs, key systems, voice mail, fax terminals, LANs, automatic call distributors (ACDs), automated attendants, paging systems, call accounting systems, call/voice processing equipment, facilities management software, centrex, long distance, and other private and public network services.

Systems integration, which developed in the computer environment, is relatively new to the telecommunications marketplace. However, the advent of new technologies and products since deregulation and the AT&T divestiture has made implementation of a business communications system much more complicated for the end user.

Increasing numbers of users (including government agencies) are turning to systems integrators to tailor a communications system to their specific needs and applications. There are currently hundreds of systems integrators offering a wide variety of products and services. The revenue potential for systems integration is staggering. In 1990, revenue to systems integrators amounted to over $8 billion. By 1992, revenues around $14 billion can be expected.

The market is composed of two distinct types of customers — business and government users. The business segment is expected to grow at almost 40 percent per year for the next several years, while the government sector, currently the larger of the two, will grow by about 15 percent per year.

Systems integration will likely continue to stimulate CPE sales. In 1990, over $2.5 billion in CPE was sold through systems integrators. That amount is likely to reach $5.6 billion by 1992.

Secondary Equipment

One of the most rapidly growing segments of the CPE market is used equipment (usually referred to as the secondary equipment market). The bulk of the equipment sold in the secondary market is key systems and PBXs but, as the secondary market develops, other types of equipment are also being remarketed. These include voice mail, call accounting, and automatic call distributors. The industry has three standards for the equipment, depending on the level of reconditioning — used, refurbished, and remanufactured. The differences between these classifications can be important not only to the customer, but also in terms of warranties.

USED EQUIPMENT — Used equipment refers to products that have been pulled from service. Usually this e-quipment has not been cleaned or tested. Most warranties on used equipment, if available at all, will not exceed a 30-day period from the date of purchase.

REFURBISHED EQUIPMENT — Refurbished equipment is the next step up the ladder. Industry practice requires not only that refurbished equipment be cleaned and tested, but that faulty components be replaced. Refurbished equipment has an extended warranty period, usually 90 days.

REMANUFACTURED EQUIPMENT — The highest level equipment can reach on the secondary market is remanufactured. Remanufactured equip-ment goes through rigorous specification testing and reconditioning. The difference between new and re-manufactured equipment is slight. Equipment that has been factory remanufactured has had faulty components replaced with new parts. This is typically not the case with refurbished equipment, where bad components may be replaced with used ones. Remanufactured equipment usually comes with a full one-year warranty.

While the secondary market is clearly becoming a force in the CPE marketplace, there are certain constraints to its continued expansion, at least in the short term. Only a small percentage of users are even aware of the secondary market. Before users will consider buying used equipment, they need to be educated about the cost savings and other advantages of secondary equipment.

In addition, many of the initial remarketers were "fly-by-night" companies that were only after a quick profit and did not stay around for service and repair. Users were not satisfied, and a questionable reputation began to haunt the industry. This perception problem is changing, however, as self-policing and official complaint-lodging mechanisms are raising industry standards. As more users learn of these developments and become more aware of avenues of recourse, they will begin to have more faith in the equipment and the vendors. Also, remarketers are beginning to grow and become substantial businesses with strong customer service resources. These capabilities help customers feel more comfortable about their purchases.

Finally, one of the main reasons users remain skeptical about the secondary equipment market is the relative lack of support from the manufacturers. AT&T's traditional support of the secondary equipment market has had some positive effect on users. However, there are dozens of other manufacturers controlling most of the installed base of equipment that traditionally have not supported the market, thereby reducing its legitimacy. But this is changing. During 1989, both ROLM and Northern Telecom announced their support of this marketplace. Other manufacturers are likely to follow suit as they try to maintain their installed base. This increasing manufacturer support will doubtless have a very positive effect on the users' perception of the industry.

The market for secondary equipment has been estimated at about $510 million in 1990 (although as noted on page 6, this figure is in dispute), with expectations that it will increase about 15 percent per year through the next several years. Currently, the bulk of the market (40 percent) is in sales directly from the remarketer to the end user. About 33 percent of the market is remarketers' sales to dealers such as interconnects, while 18 percent represents sales from the user to the remarketer. The balance of the market is accounted for by intracompany transfers and user-to-user sales.

In terms of value, the market is split fairly evenly between system sales and sales of parts only. More dealers offer parts than complete systems, but the dollar value of the systems sales compensates for the smaller number of remarketers .

PBX components account for some 45 percent of the secondary market, while PBX systems account for 20 percent and key systems for 35 percent. As for PBX manufacturer market shares in the secondary market, AT&T products have about 40 percent, Northern Telecom about 20 percent, ROLM 10 percent, Mitel 13 percent, and NEC 7 percent.

The secondary market is currently doing very well, since there exists a window of opportunity. Customers who bought their systems in 1984 and 1985 are beginning to look for replacement systems. There is also a certain amount of confusion in the marketplace regarding technology and price. How will ISDN be incorporated into CPE? Is centrex the "true" gateway to ISDN? Is digital the technology of choice for key systems? These questions lead many users to view the secondary market as a relatively inexpensive "stopgap" measure until some of these issues are resolved. Beyond these issues, the slowdown in the U.S. economy that began in the second half of 1990 will likely give an added push to the secondary market as users try to get the most they can out of their shrinking budgets. It may be that the secondary market will always remain strong; it is a bit too early to tell.

Centrex CPE

Centrex services were introduced by AT&T and the Bell Telephone System around 1961 as the preferred service offering for large institutional and corporate accounts. To provide centrex, the local telephone company dedicates lines and capacity within a CO switch to an individual customer. Thus the intelligence and switching capability of the system reside at the CO rather than on the customer's premises, as is the case with a PBX-based system. (See the section on the PBX/centrex marketplace for a complete discussion.)

Prior to the AT&T divestiture, AT&T encouraged a decline in centrex penetration due to AT&T's commitment to the PBX marketplace. In the post-divestiture climate, however, the RBOCs have been barred from manufacturing (although they have been allowed to sell CPE within certain guidelines), and have moved to revive and promote centrex services aggressively, especially in urban markets. The RBOCs have made centrex their flagship business telecommunications offering, and to make it more competitive with PBXs they have fought for, and won, rate reductions and in many cases, deregulation, detariffing, or customized tariffing of centrex service. In addition, the RBOCs have enhanced centrex with advanced features once available only with a PBX.

In this environment, centrex has flourished, and so has the market for CPE used in conjunction with centrex. The most widely used types of such equipment are key systems, with almost 75 percent of all centrex installations using key stations. Other CPE frequently used with centrex includes answering machines, auto dialers, intercoms, paging systems, ACDs, call accounting, and voice mail.

In value, the total annual sales of all centrex CPE for 1990 amounted to about $340 million, with the biggest sellers being voice messaging equipment at about $185 million, key systems at about $95 million, and ACDs at about $35 million. In units, big sellers in 1988 included key systems at about 40,000 systems, and call accounting and voice messaging equipment, each at about 4,000 units. The markets for these products are likely to increase as centrex penetration increases.

The RBOCs are beginning to incorporate ACD and voice mail features into their centrex offerings, which may keep the market in check, at least for these features. This will cause some displacement of CPE, but so far the sophistication of these centrex features is not equal to the CPE versions and their cost is relatively high. In the near term, at least, the CPE versions should do quite well.

INTERCONNECT INDUSTRY REVIEW

CAVEAT

About PBX Statistics

Despite the somewhat optimistic character of NATA Survey results for the interconnect industry, readers should be cautious about how they use these figures for market planning in projecting future sales. There is some evidence to suggest that the 1990-1991 recession has had a deeper impact on the communications equipment manufacturing industry than was anticipated when responses were made to the NATA survey. A few major manufacturers have reported that normal sales would have been off 25 to 50 percent, but for unanticipated, customer base sales of fairly large PBX systems. Those making these reports, while obviously pleased with the results, did not see these exceptional sales as usual business activity in a healthy economy. Normally, they would have represented an increase in annual volume instead of sales that saved the year.

The recession also raises questions about the figures NATA and other analysts use in estimating current and future market volume. For 1991, NATA estimates that PBX line sales will be up about half of one percent, from 4.005 million lines in 1990 to 4.025 million lines. After the NATA survey was complete, several manufacturers and suppliers reported that 1991 sales were down 10 to 20 percent due to the recession. If these reports reflect performance in the industry generally, 1991 PBX sales will be off NATA's projection by about $383 million, and shipments for the year probably will not exceed 3.4 million lines.

Moreover, several astute industry observers say they have doubts about the volume of PBX sales NATA and other analysts have been reporting; namely, sales in the area of 4 million lines a year. These observers quite rightly point out that the percentages by which sales are down should not be as far off the general economic decline as some of the reports indicate. Rather, they should be tracking with the recessionary decline and not exceeding it to the extent reported. Therefore, they think the total PBX market in normal years, and under healthy economic conditions, may not be more than 2.5 to 3.5 million lines.

NATA finds enough validity in these views to justify using the new 1991-1992 surveys and other techniques to reaffirm the projection methods used in past editions of the NATA *Market Review and Forecast* or to revamp them entirely. We can, however, assure readers that if the information on market size changes, the market shares we publish will not. We are currently satisfied that our market share information is accurate.

Since we know the NATA *Market Review and Forecast* is used for market planning, we strongly encourage readers to adjust our figures by their 1990-1991 performance results. As nearly as we can tell, the telecommunications equipment industry has been in recession since the third quarter of 1989, and was particularly hard hit in the last two weeks of December 1990 and the first quarter of 1991. Therefore, prudence for planning purposes and for solid profits in 1992 suggests that sizing business activities to lower performance results may make a lot of sense. Performance of the economy is likely to be sporadic over the next year, even if the recession moves off the horizon.

Interconnect Industry Review

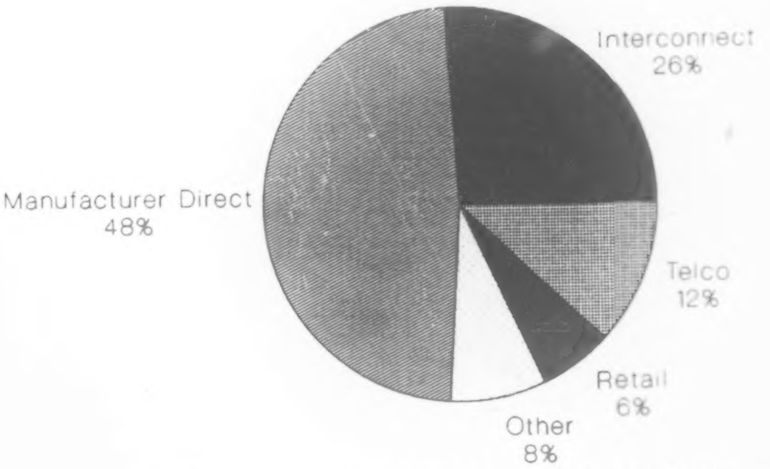
Overview

The non-telco CPE industry was born in 1968, with the FCC's *Carterfone* decision, which struck down AT&T's policy of prohibiting the interconnection of non-AT&T communications equipment to the telephone network. The competitive CPE industry brought to the marketplace a wealth of new business telecommunications products and a dedication to customer service. As a result, the industry grew rapidly and for several years was very profitable. As the industry expanded, however, the number of vendors began to exceed the demand for new equipment, and the industry began to experience growing pains. By the mid 1980s, it became clear that supply exceeded demand and price competition began to accelerate, reducing industry profitability and overall health.

The CPE industry is enduring a period of consolidation and retrenchment as companies respond to changing market conditions. Events of the last several years point to a shift in distribution from independent distributors to manufacturer-direct sales. Mitel's purchase of RCA and Coradian and NEC and TIE's purchase of a number of smaller independent distributors are part of this continuing trend of manufacturers' seeking to control their equipment distribution.

Figure 17

1990 CPE Market by Distribution Channel



1990 Total Market $13.2 Billion

Source: NATA Market Research Department

This trend, combined with mergers among independent distributors and the increased participation of the RBOCs in the CPE market, is leading to a decrease in the number of independent distributors. The shakeout of companies is expected to continue in the near term, making the vendor market much more concentrated by the end of the decade. The unrealistic price competition that has plagued the industry since 1984 will eventually be corrected. Individual CPE vendors remaining in the market will be well positioned to take advantage of newly emerging opportunities in a fairly implemented ISDN, systems integration, videoconferencing, voice processing, and other growing market segments.

Successful CPE vendors acknowledge they can no longer rely on new system sales for their bread and butter. They are increasingly diversifying revenue streams into other, more lucrative areas such as peripheral equipment sales and dealerships with local and long distance companies. In addition, the secondary equipment market is becoming an important focus for many vendors. Some vendors are expanding into systems integration to increase the range of products and services they offer. Many are learning that total service and one-stop-shopping can be an avenue to profitability in a highly competitive environment.

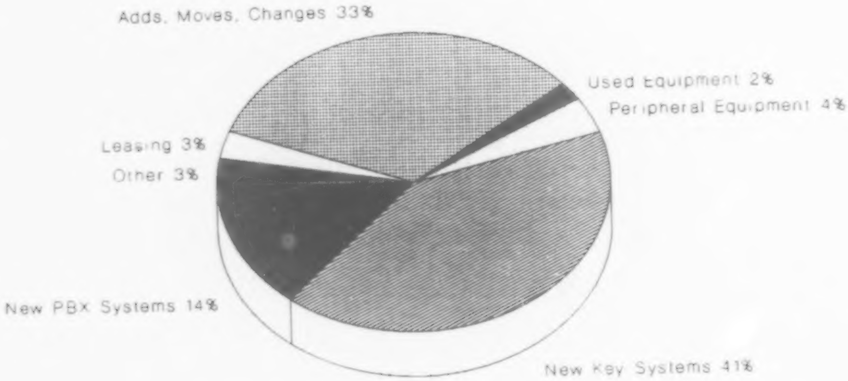
Industry Analysis

NATA conducted a market survey of members in the interconnect industry in early 1991. The survey focused on revenue sources, services offered, productivity, and vendor expectations. Much of the industry analysis in this section is based on the results of that survey.

There are some 10,000 CPE vendors in the

Figure 18

1989 CPE Distributor Revenue by Source



Source: NATA Market Research Department

United States. They range from small independent distributors with annual sales of six figures to large manufacturer sales organizations and RBOC CPE affiliates with annual sales of hundreds of millions of dollars. The vast majority of nationwide CPE sales is accounted for by some 1,000 to 1,200 companies, many of which have sales outlets in more than one state.

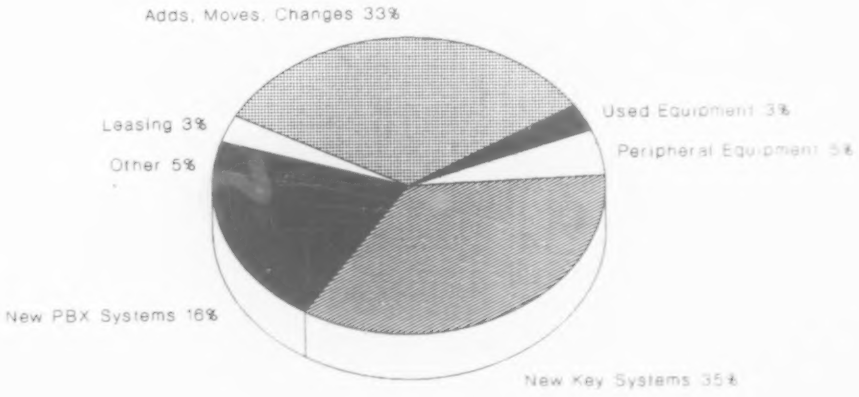
Total CPE sales through all sales channels amounted to $8.7 billion in 1988 and increased to $13.2 billion in 1990 (Table 19, page 92). This is expected to increase to $16.2 billion in 1991. In 1990, approximately 26 percent of the market consisted of sales by independent distributors (interconnects), 48 percent by manufacturer-direct sales, 12 percent by telco sales, 6 percent retail sales, and the rest by other channels (Fig.17, page 83). The balance of this discussion focuses on interconnects and manufacturer-direct sales, hereafter together referred to as CPE distributors. This has been the segment of the CPE industry most responsible for capitalizing on new opportunities and for providing customers with innovative business products.

CPE Distributor Revenue Sources

Over the past several years, CPE distributors have begun to turn their attention away from new system sales and focus more on revenue potential from nontraditional sources. At one time, most of a CPE distributor's revenue was derived from new PBX or key system sales. In 1989, sales of new PBXs on average accounted for 14.3 percent of a typical CPE distributor's total revenue, and sales of new key systems accounted for 40.4 percent (Fig. 18, page 84). In 1990, new PBX sales and new key system sales accounted for 14.9 percent and 35.4 percent, respectively, of a

Figure 19

1990 CPE Distributor Revenue by Source



Source: NATA Market Research Department

typical CPE distributor's total revenue (Fig. 19, page 85).

Increasingly, CPE distributors are looking to sales of peripheral equipment such as voice mail, call accounting, etc. (see discussion below) to enhance their bottom line. In 1990, peripheral sales accounted for 5.2 percent of a typical distributor's total revenue, up from 4.0 percent in 1989. Other areas of growing interest include used equipment and sales agency arrangements with local and long distance carriers.

CPE Distributor Expense Analysis

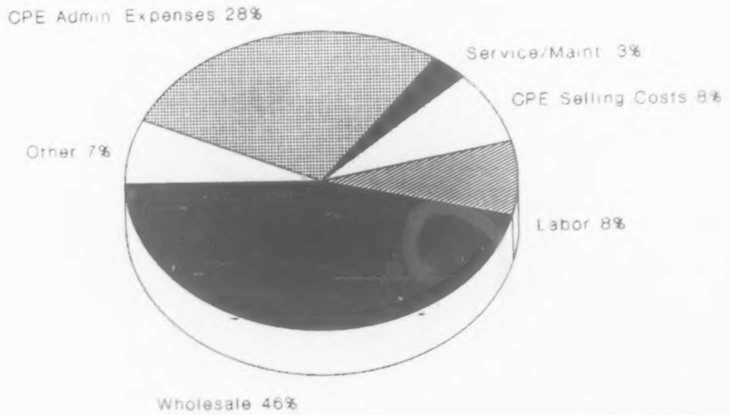
As expected, the largest expense for a CPE distributor is the cost of the equipment itself. In 1989, the average CPE distributor spent 45.8 percent of total expenses on equipment. This decreased somewhat in 1990, when equipment costs accounted for 38.7 percent of total expenses. Overhead was the next largest expense, accounting for 28.0 percent of the total in 1989 and 26.1 percent in 1990. Other important cost items were labor (installation) and CPE selling costs (commissions, wages, and advertising). Labor costs accounted for 9.4 percent in 1990, up from 8.3 percent in 1989, while CPE selling costs accounted for 9.5 percent in 1990, up from 7.9 percent in 1989 (Fig. 20 and Fig. 21, page 87).

1990 Gross Profit Margin Analysis

Gross profit margins on the various types of equipment sold by CPE distributors fluctuated between 24 percent and 51 percent (Fig. 212 page 88). The most profitable segment of the CPE distributor's business in 1990 was in the sale of used equipment, at 51 percent. The next most profitable segment was the sales agency arrangement some CPE distributors

Figure 20

1989 CPE Distributor Expenses by Type



CPE Admin. Expenses includes overhead, taxes, etc.
CPE Selling Costs includes commission, wages, advertising
Labor covers installation
Wholesale includes equipment and materials

Source: NATA Market Research Department

have with RBOCs, at 45 percent. Other profitable segments of the business included service calls and adds, moves, and changes.

When asked how they anticipated profit margins to change comparing 1991 with 1990, most NATA survey respondents felt that for most segments of the business there would be increases in the profit margins. The area where most CPE distributors were optimistic was in long distance service sales. Almost 90 percent felt margins would increase. Distributors were also optimistic about profitability of RBOC sales agency arrangements, used equipment sales, and service calls. They were least optimistic about new PBX sales and overall peripheral sales (Fig. 23, page 89).

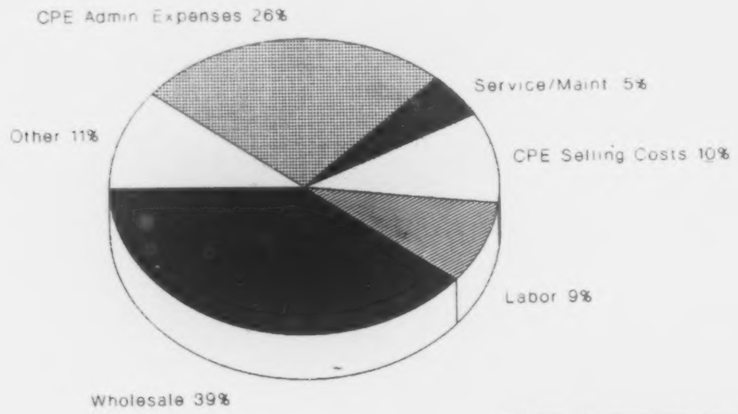
1991 Financial Outlook

Despite the soft economy the U.S. has experienced the past year, most CPE distributors anticipate better times in 1991. When asked to evaluate anticipated regional economic conditions for 1991, most CPE distributors indicated they have a fair amount of confidence in their local economy. On a scale of 0 to 10, with 0 representing no confidence in economic growth and 10 representing full confidence, the Northeast earned a rating of 5.0, while all other regions fared at least somewhat better (Fig. 24, page 90).

Perhaps even more surprising, when asked how they expected their total revenue to change comparing 1990 with anticipated revenue for 1991, 48 percent of all respondents indicated they thought their revenue would increase by more than 10 percent (Fig. 25, page 90). Altogether, 68 percent thought their revenue would increase by some amount. Only 14 percent thought their revenue would decrease, and only 2 percent thought their revenue would decrease by more than 10 percent.

Figure 21

1990 CPE Distributor Expenses by Type



CPE Admin. Expenses includes overhead, taxes, etc.
CPE Selling Costs includes commission, wages, advertising
Labor covers installation
Wholesale includes equipment and materials

Source: NATA Market Research Department

Overall, it appears that CPE distributors feel that they have already experienced the worst of the economic downturn, and that the rest of the year will prove to be somewhat better. This seems to follow some of the general economic forecasts the U.S. government issued at the end of first quarter 1991.

Popular Peripherals Sold in 1990

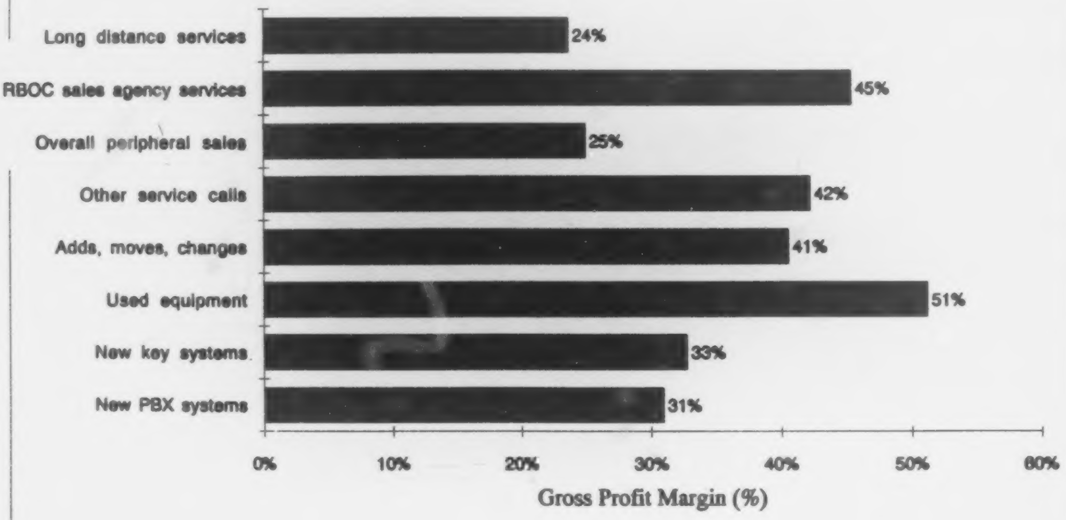
The most popularly sold peripheral in 1990 by CPE distributors was voice mail systems. Almost 90 percent of the respondents already sell voice mail systems; those who don't now plan to in the near future (Fig. 26, page 91). Other popular peripherals sold in 1990 include call accounting, intercom/paging, power protection, facsimile terminals, ACDs, and least cost routing. The least popular products for distributors in 1990 were computer work station and security systems. Almost 30 percent indicated they offered multiplexers, PCs, and LANs.

A Look to the Future

The CPE distributor industry is clearly undergoing a period of transition. Not only are the products being sold changing and combining aspects of voice, data, image, and video, but market conditions are changing as well. Price competition is slowly being replaced by competition based on service and technical competence. Customers are becoming increasingly sophisticated and demanding in what they expect from their telecommunications vendor. This requires a change in marketing for CPE distributors. Those that rely heavily on merely "pushing boxes out the door" will find that hard times are ahead. Those who

Figure 22

1990 Gross Profit Margin by Business Segment

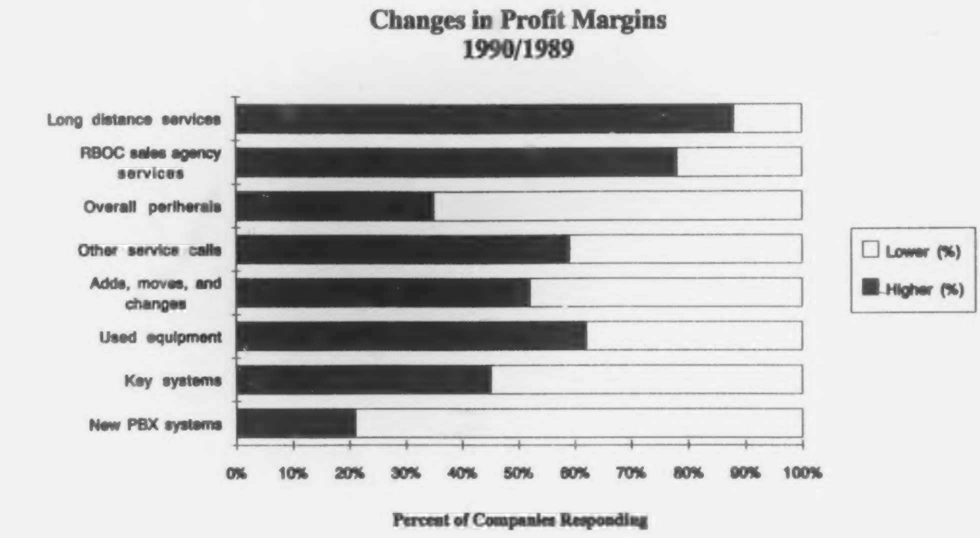


Source: NATA Market Research Department

make a point of understanding the unique attributes of their customers' business and aggressively market themselves as "solution providers" will find significant business opportunities. In addition, CPE distributors must turn their attention to the installed base of customers. Those that do will find a bonanza of opportunity. In short, the successful CPE distributor of the future will understand the latest technology in voice, data, image, and video, and will understand how to combine these technologies into applications that suit the specific needs of current and potential customers.

Figure 23

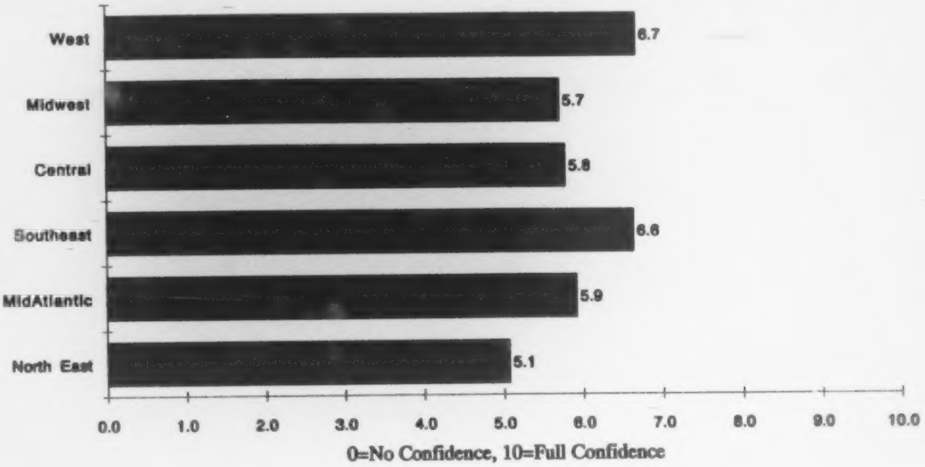
Anticipated Change in Profit Margins, 1990-1991



Source: NATA Market Research Department

Figure 24

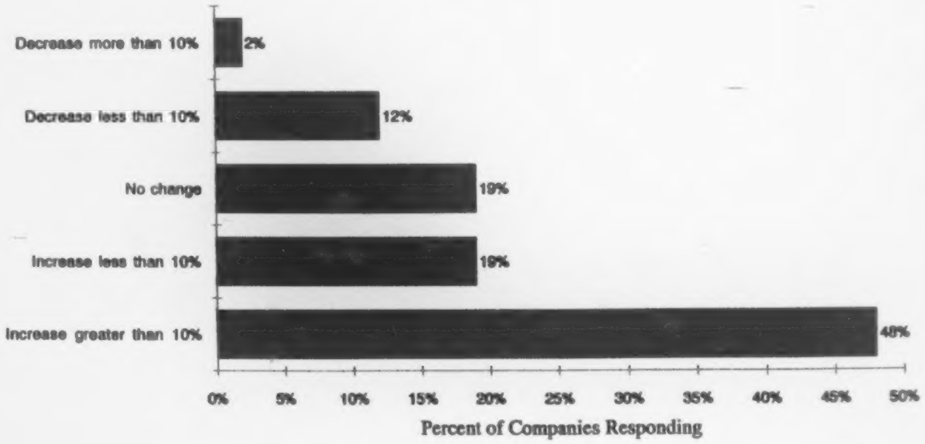
1991 Confidence Ratings in Regional Economies



Source: NATA Market Research Department

Figure 25

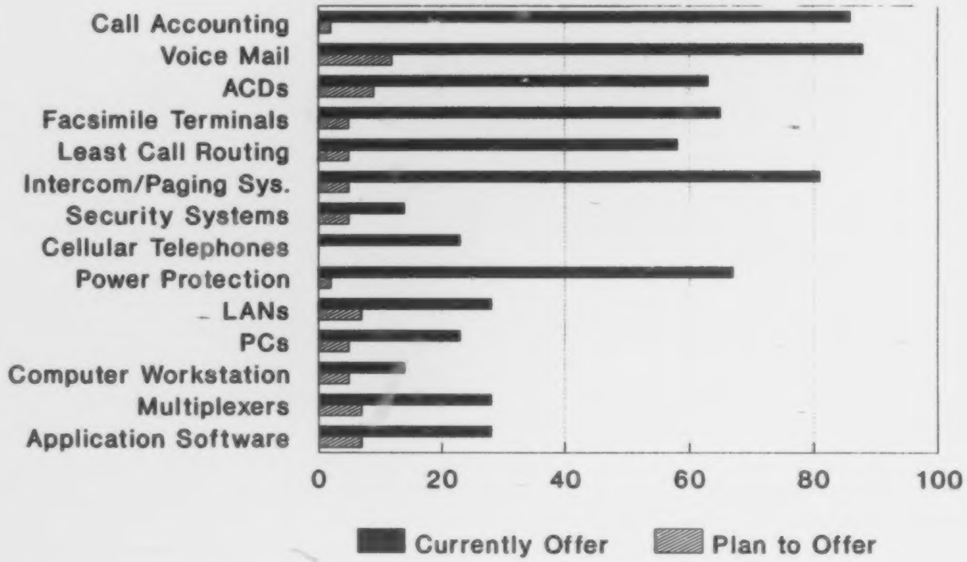
Anticipated Change in Revenue, 1990-1991



Source: NATA Market Research Department

Figure 26

1990 Popular Peripheral Equipment Sold



Source: NATA Market Research Department

Table 19

Business CPE* Sales by Product, 1988-1991

(millions of dollars)

	1988	1989	1990	(p) 1991
PBXs	2,928	2,875	2,590	2,552
Key Systems	965	995	1,025	1,100
Fax Terminals	1,100	2,855	4,422	6,571
Station Sets** (Sold Separately)	1,825	1,875	1,890	1,975
Voice Processing	1,185	1,590	2,213	2,735
Other***	738	915	1,103	1,288
Total	8,741	11,105	13,243	16,221

* Excludes most data communications equipment.

** Includes consumer telephone instruments.

*** Includes call accounting, paging/intercoms, power protection, etc.

(p) Projection

Source: NATA Market Research Department

SELECTED CPE MARKETS

PBX/Centrex Market
Key/Hybrid Market
Data Communications Equipment Market
Facsimile Terminal Market
Consumer Telecommunications Market
Call/Voice Processing Equipment Market
Public Payphone Market
Videoconferencing Market

SELECTED CPE MARKETS

PBX-Centrex Market

Introduction

Private branch exchanges (PBXs) are multi-line business telephone systems giving users pooled access to a group of external telephone lines provided by the local telephone company's central office. PBX systems provide essentially the same services as a telephone company central office — dial tone signaling and call routing — but on a much smaller scale and typically from equipment located on a customer's premises. A PBX is often referred to as a switch because, like a central office, it automatically establishes and routes (or switches) calls between the various stations on a user's premises or between an on-premise extension and the public switched network. A distinguishing characteristic of PBX systems is the users' pooled access to outside CO lines. When a user dials "9" or another designated code from an extension, the switch automatically seizes an idle outside line from a pool of available CO lines to complete the call.

In general, PBXs are being equipped with more and more features, such as integrated call distributors, cost accounting, and voice messaging, as well as the ability to bridge local area networks and have full data communications capability. Digital PBXs are replacing analog PBXs, which themselves replaced electromechanical types not too many years ago. Several manufacturers have recently announced ISDN-compatible PBXs. Even though ISDN is several years away from commercial implementation, manufacturers want to sell PBXs today that will be forward compatible.

"Centrex" is the generic name for a switching service offered by local telephone companies to business customers. Centrex service provides businesses with PBX-like features and capabilities directly from the central office, rather than through premises-based PBX equipment. That is, centrex service is provided from the same local switching center that provides business and residential customers alike with dial tone, local call-routing, and access to long distance networks. In order to provide centrex, the local telephone company merely dedicates lines and capacity within the CO switch to an individual customer.

Typically, centrex service consists of two elements: local-exchange access and switching; and intercom service with a package of call-processing features similar to those available from PBX systems. Centrex has generally been treated as a regulated service, and prices are usually set in tariffs approved by state regulators. There are two growing trends, however: to allow flexible tariffing of centrex, sometimes including customized service packages to larger customers where the actual price of the centrex service itself may not be revealed; and to deregulate centrex service completely. In any event, centrex prices tend to vary from state to state.

Three types of CO switches, distinguished by the technologies they embody, currently provide centrex service in various parts of the country: electromechanical, stored program-controlled electronic, and digital.

Prior to the breakup of the Bell System, the use of centrex — confined primarily to the very large business market — was declining; this was the result of a deliberate policy of AT&T. Since divestiture, however, the RBOCs have moved aggressively to revitalize and promote centrex, especially in urban markets. To increase the appeal of the service to businesses, the RBOCs have fought for and won deep centrex rate reductions, as well as enhanced feature offerings and lowered minimum line-size restrictions, from state regulators.

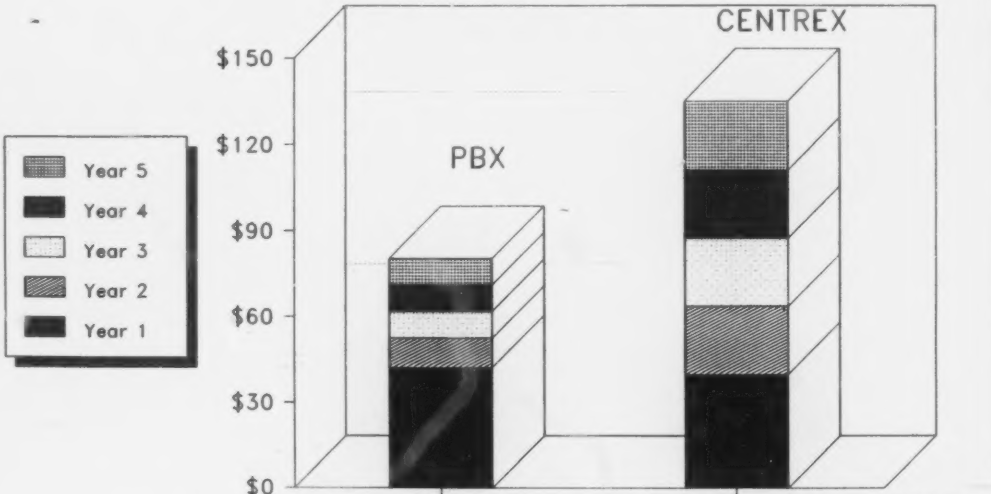
Centrex services are currently sold through four channels: the telephone companies' own sales force; centrex resellers; authorized third party sales agents who get commissions from the telephone companies; and other companies that, as a service to their CPE customers, frequently order centrex service for the customer, though they do not receive any commission for the sale. These vendors must make up the associated costs of marketing centrex through other areas of their businesses. At the urging of NATA, the FCC established the authorized sales agency program as an essential safeguard and precondition to relief for the BOCs from separate subsidiary regulations.

From a user's point of view, there are advantages and disadvantages to both centrex and PBXs. The debate concerning which is better has been a popular subject in the trade literature, with one source claiming one is superior to the other and the next claiming the opposite. In terms of cost to the customer, they are roughly equal, with PBXs having some advantage in the longer term, at least for certain system sizes (Fig. 27). In terms of functionality and general user satisfaction rating overall, they come in a dead heat, although there are individual differences in ratings by PBX manufacturers and RBOCs (Figs. 28 and 29, page 97).

Figure 27

PBX-Centrex Price Comparison over a Five-Year Period for a 50-Line System

Thousands of Dollars



Recurring costs:Yr 1–$6,372
Yrs 2–5–$9,252/yr
Nonrecurring costs: $36,865
Hidden Costs: $28,085

5 Year Total–$108,330

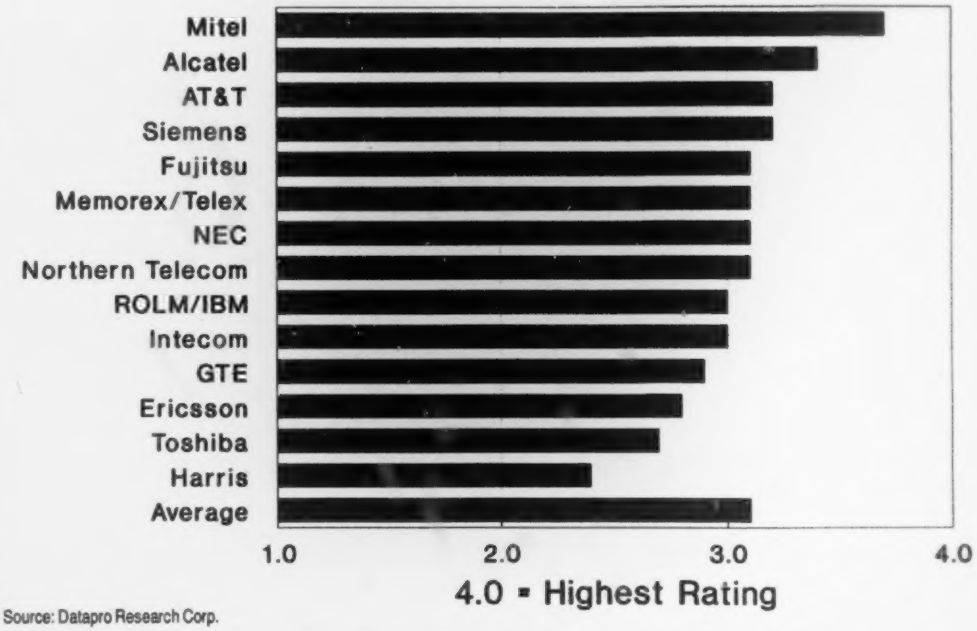
Recurring Costs: Yr 1–$23,220
Yrs 2–5–$23,820/yr
Nonrecurring costs: $16,500
Hidden Costs: None

5 Year Total–$135,000

Source: Eastern Management Group

Figure 28

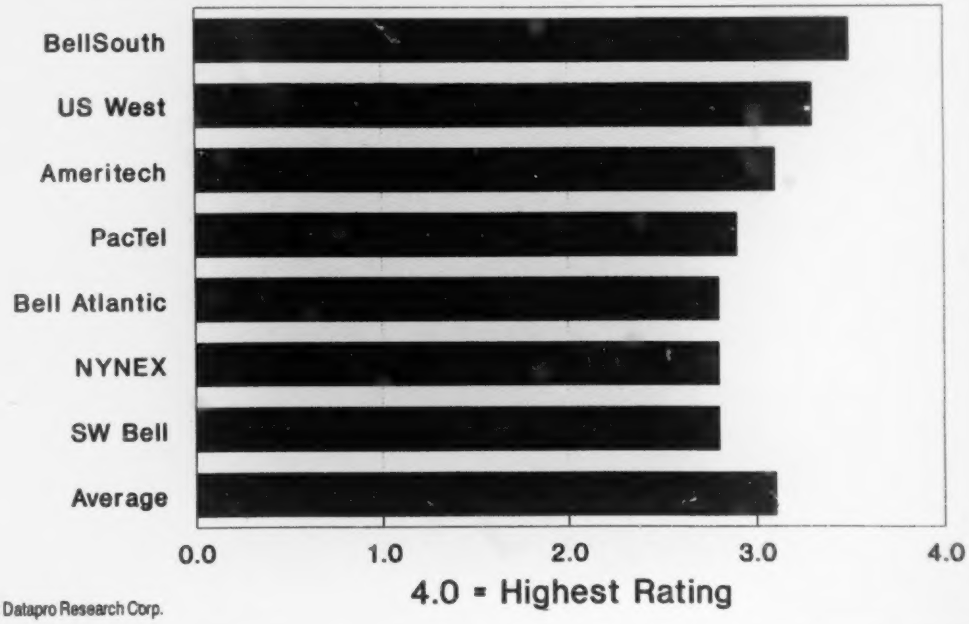
1989 User Satisfaction Ratings of PBXs by Manufacturer



Source: Datapro Research Corp.

Figure 29

1989 User Satisfaction Ratings of Centrex Services by RBOC



Source: Datapro Research Corp.

Market Review

Total annual PBX line sales have grown rather slowly and unevenly over the past several years, from 3.8 million lines in 1984 to 4.0 million lines in 1990 (Table 20, page 108, and Fig. 30). As the replacement market picks up and ISDN stimulates demand, lines shipped are expected to increase to 5.4 million by 1995. In systems, annual shipments increased from 25 thousand units valued at $2.8 billion in 1984 to 26 thousand units valued at $2.6 billion in 1990. System sales are expected to amount to 32 thousand units valued at $3.4 billion in 1995. This upturn is expected as the PBXs that were purchased in the buying spree of 1984 and 1985 need replacement in the coming few years. Table 21, page 109, identifies the PBX market potential for the top 30 metropolitan areas.

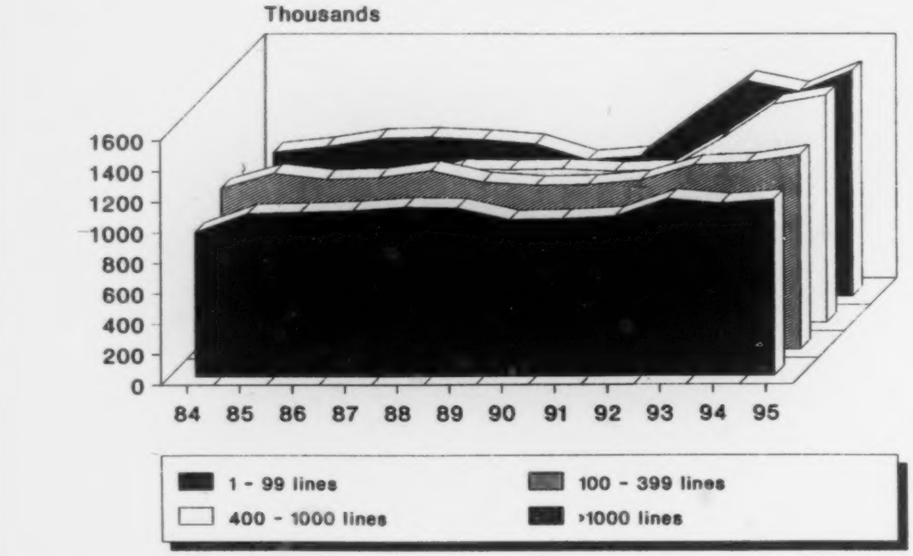
In an attempt to shore up sales, PBX manufacturers have been buying up interconnect companies in recent years. Manufacturer-direct sales (including sales through wholly-owned subsidiaries) increased from 50.4 percent of the market in 1986 to 55.2 percent in 1990 (Table 22, page 110). Sales by independent interconnects decreased slightly from 24.1 percent to 21.4 percent (Fig. 31, page 99). Wholesale houses lost ground from 9.7 percent to 6.1 percent for the same period, while the RBOCs' share went from 11.6 percent to 13.0 percent. The share of total sales by independent telephone companies decreased slightly from 4.4 percent in 1989 to 4.3 percent in 1990.

PBX-Centrex Installed Base

The total installed base of PBXs increased from 21.9 million lines in 1984 to 25.2 million

Figure 30

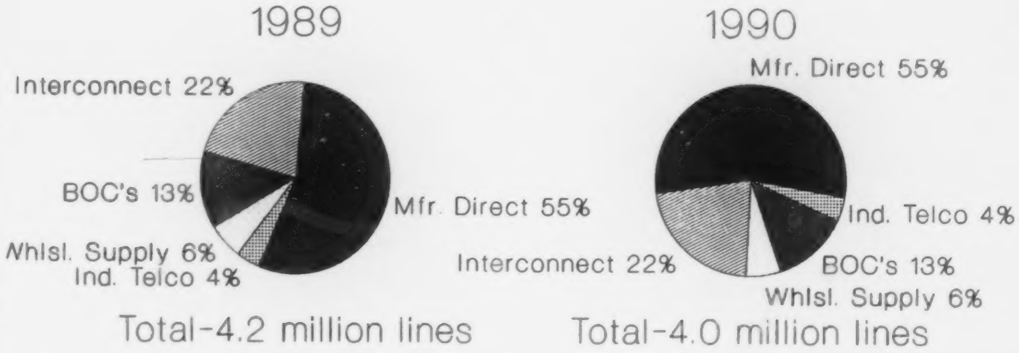
PBX Market by System Size, 1984-1995



Source: NATA Market Research Department

Figure 31

PBX Shipments by Distribution Channel, 1989-1990

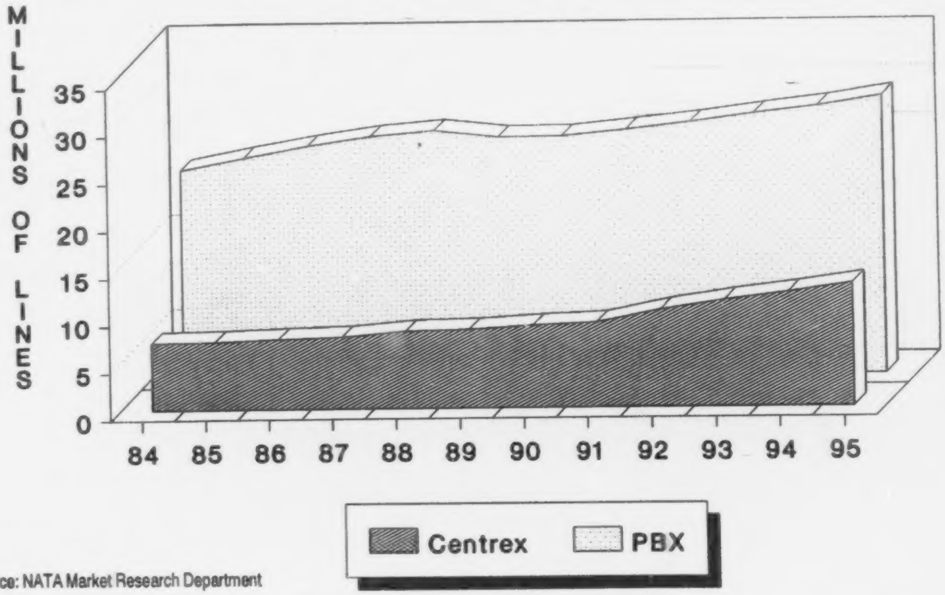


Source: NATA Market Research Department

Figure 32

PBX-Centrex Installed Base Development, 1984-1995

(PBX CAGR = 3.1%; Centrex CAGR = 8.9%)



Source: NATA Market Research Department

in 1990 and is expected to increase to 29.2 million lines by 1995 (Table 28, page 113, and Fig. 32, page 99). The segment likely to do best between 1990 and 1995 will be 400-1,000 line systems. In the last few years, centrex growth has been especially strong in systems above 1,000 lines and systems between 1 and 99 lines. Telephone companies have targeted the largest businesses for centrex conversion and, for the most part, have encouraged centrex sales by authorized third-party sales agents to smaller customers.

For individual RBOCs, the largest installed base of PBX lines and centrex lines is in Bell Atlantic's territory, where over 4 million PBX lines and almost 2 million centrex lines are installed (Table 23, page 111). As a percentage of total centrex/PBX installed base, Ameritech has the highest penetration of centrex lines at 35 percent (Fig. 33). Fig. 34 on page 101 illustrates the degree of success the RBOCs have had in selling PBXs in their own territories.

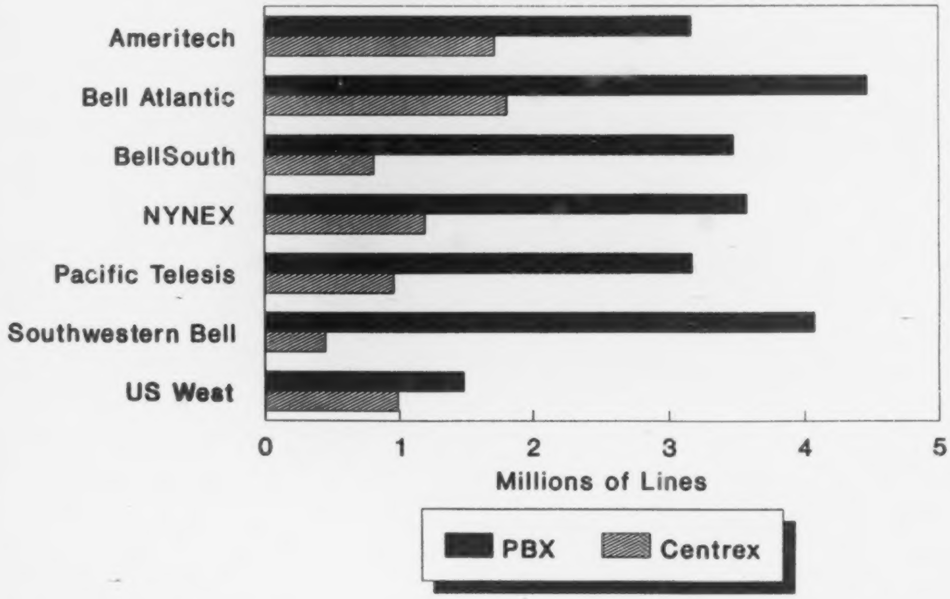
In terms of individual end-user business markets, manufacturing had 4.1 million PBX lines installed and banking/finance and engineering/legal/management services each had 3.8 million PBX lines installed (Fig. 35, page 101). The government sector has the highest number of centrex lines in place (Table 24, page 111). As a percentage of total centrex/PBX installed base, the government sector has the highest percentage of centrex lines installed.

Manufacturer Trends

The PBX market is highly competitive. Aside from the tremendous competition be-

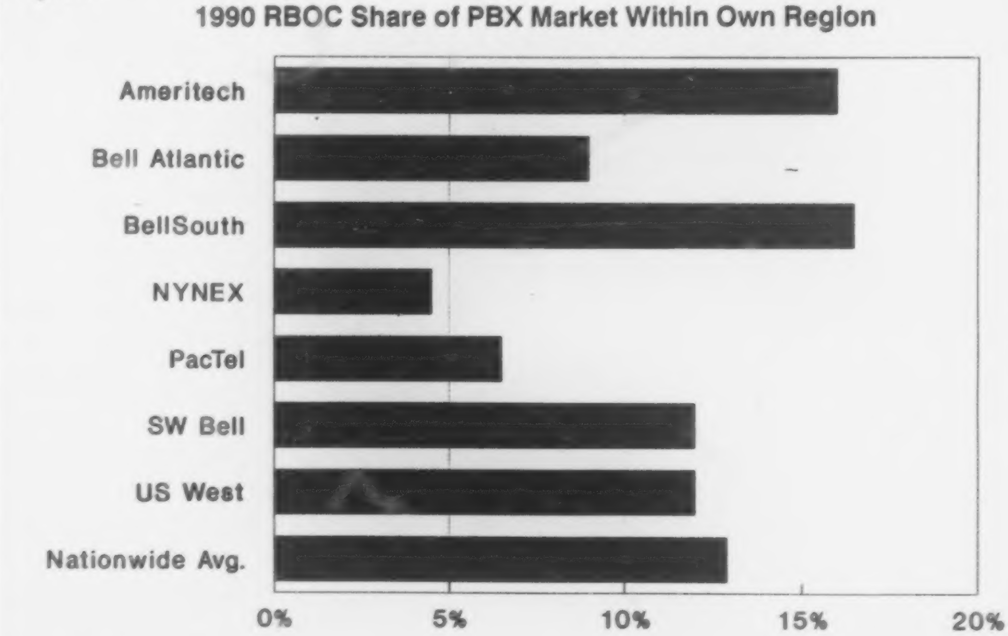
Figure 33

1990 PBX-Centrex Lines Installed by RBOC Region



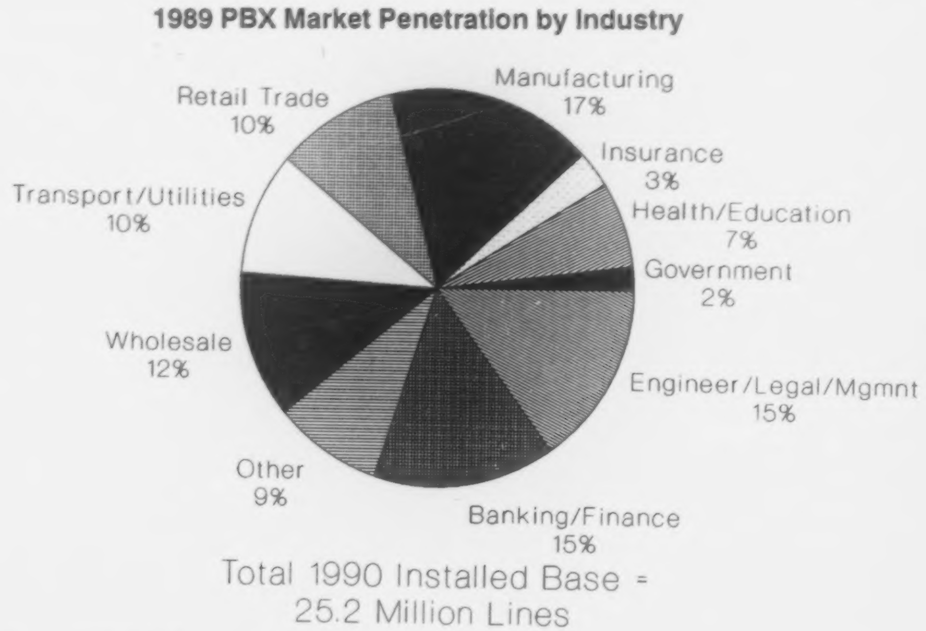
Source: NATA Market Research Department

Figure 34



Source: NATA Market Research Department

Figure 35



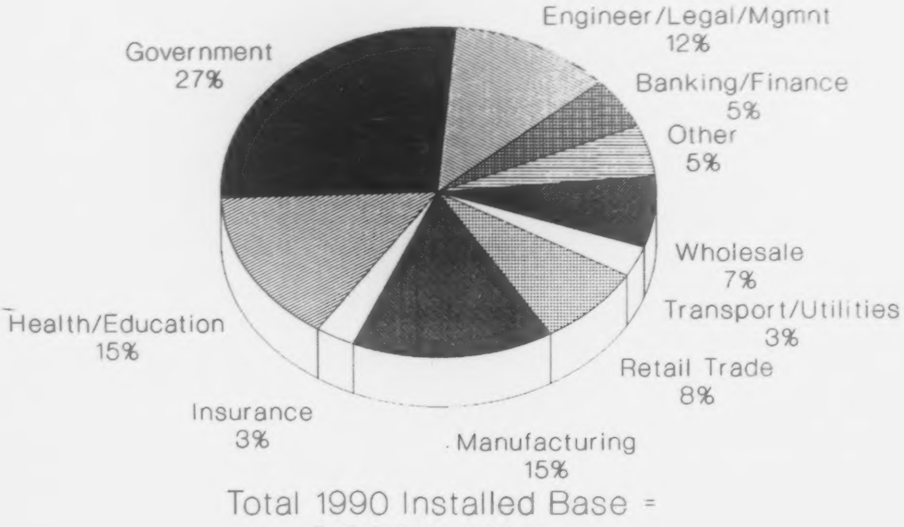
Source: Gartner Group and NATA Market Research Department tween centrex and PBXs, there are dozens of companies trying to capture more market share for a product whose demand is relatively stable. This crowding of the PBX market inevitably produces severe price competition. While there is a range of PBX prices based on system size and configuration, overall PBX prices per line on the average declined two percent between 1984 and 1990 (Table 25, page 112 and Fig. 37, page 103). This compares to overall increases in the consumer price index of 22 percent since 1984. The slide in PBX prices is expected to moderate as prices during the period 1990 to 1995 are expected to drop only 0.6 percent per year. The resulting decrease in profit margins has been highly problematic for PBX vendors who are having trouble maintaining revenue (Table 26, page 112).

In addition, even though some suppliers have been able to increase total revenue, price erosion has made it very difficult for them to attain profitability. This downward trend is expected to continue, as manufacturers spend more and more money on R&D to remain competitive in an ISDN environment while prices remain stable. Manufacturers have already begun to prepare for an all-digital environment and are shipping significant quantities of digital PBXs.

The principal avenue manufacturers will take to increase their profitability is the continued acquisition of distribution channels to stabilize distribution and to take advantage of more profitable after-market sales. (Some analysts argue that direct distribution brings more problems than solutions and that in the long run direct sales are more costly than sales

Figure 36

1989 Centrex Market Penetration by Industry

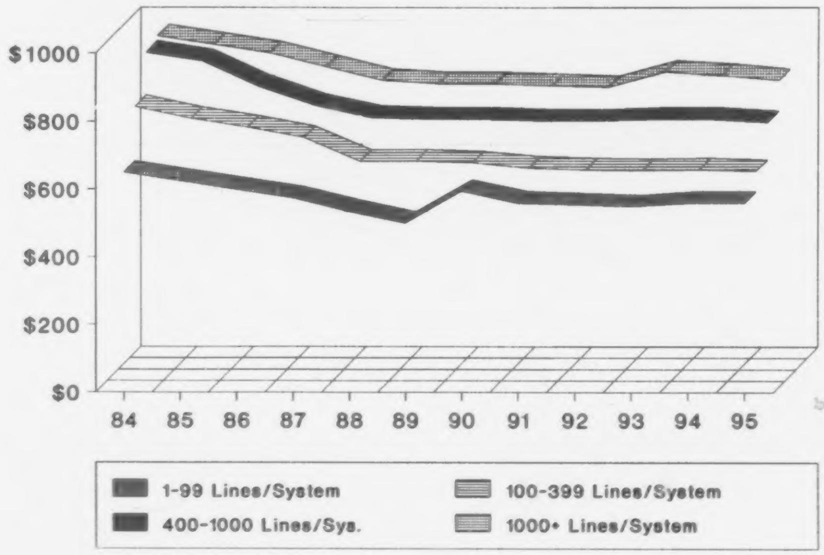


Total 1990 Installed Base = 8.6 Million Lines

Source: Gartner Group and NATA Market Research Department

Figure 37

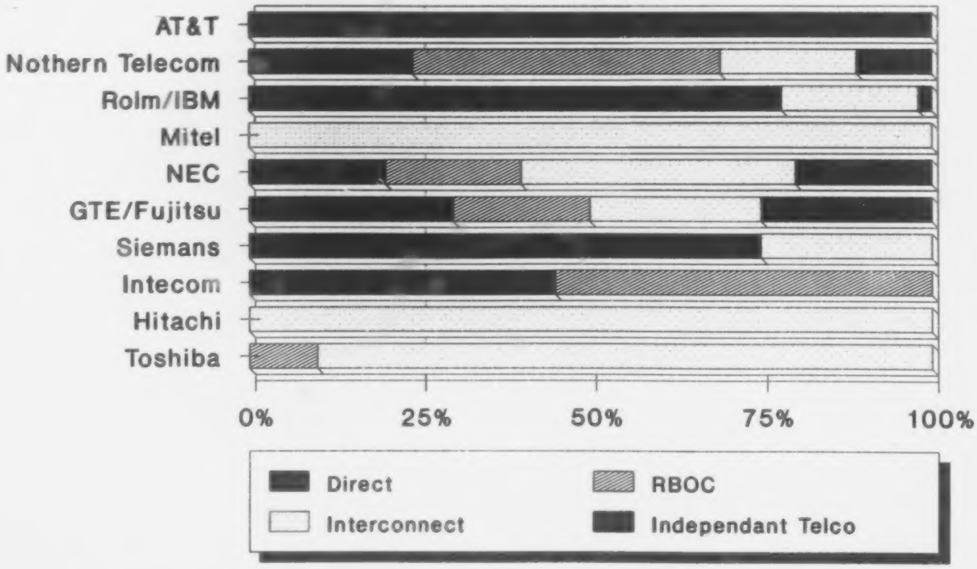
PBX Prices per Line, by System Size, 1984-1995



Source: NATA Market Research Department

Figure 38

1990 PBX Distribution Channels by Company



Source: NATA Market Research Department

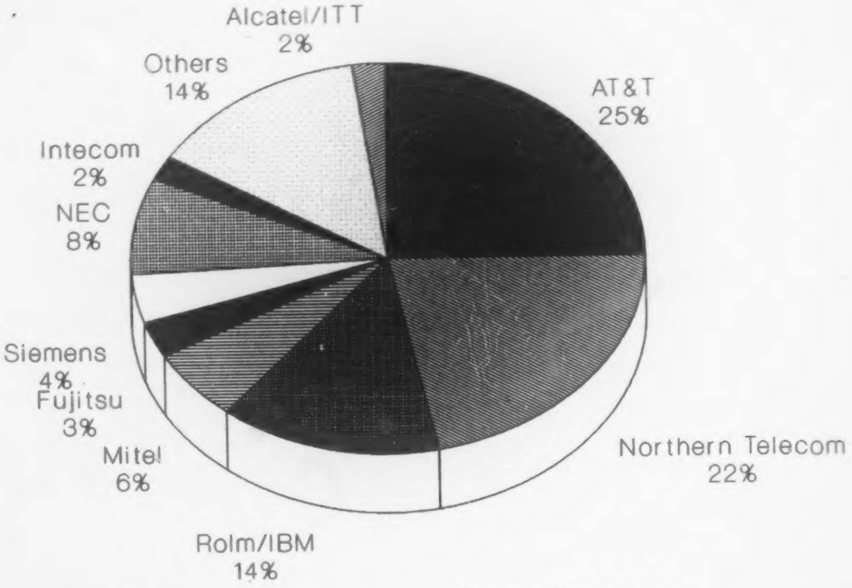
through independent distributors.) Currently, most manufacturers split their distribution among a variety of channels (Fig. 38, page 103). This varied approach to distribution is likely to continue, but manufacturer direct sales are likely to capture an increasing share of total PBX distribution. In addition, manufacturers are offering more in leasing and financing arrangements in order to be more attractive to customers. Several other manufacturer strategies are impacting the market. AT&T, and a few other manufacturers to a lesser degree, have declared a virtual installed base war. They are launching aggressive campaigns to convince users of competing systems to switch brands of PBXs. In an effort to satisfy their installed base, manufacturers are increasingly making their PBXs modular in nature to reduce the requirement for a total system replacement when customers need system expansion or upgrading.

In terms of shares, AT&T, Northern Telecom, and IBM/ROLM had the lion's share of the 1990 market, collectively accounting for 60 percent of the total lines shipped (Table 27, page 113, and Fig. 39). Other important players include Mitel, NEC, Siemens, and Fujitsu, accounting for 6 percent, 8 percent, 4 percent, and 3 percent, respectively, of the total lines shipped in 1990.

In addition to ISDN-compatibility, PBX manufacturers are turning to new bells and whistles to increase PBX sales. The three that seem to be getting the most attention are wireless PBXs, PBXs with open application interfaces (OAI), and PBXs with links to host computers.

Figure 39

1990 Manufacturer Market Shares of PBX Line Shipments



1990 Total Market = 4,005,000 Lines

Source: NATA Market Research Department

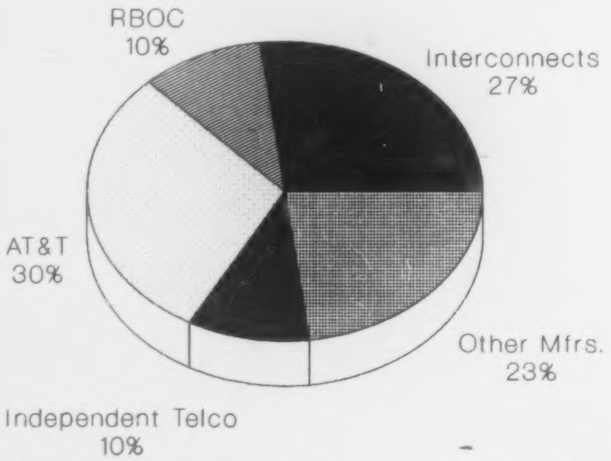
Wireless PBXs are those connected to the station sets by radio waves rather than wire. This gives users control of station placement and eliminates the need for a service call when merely moving station equipment from one office to another. The technology for wireless PBXs is not particularly revolutionary, but there is some problem with allocation of the limited radio spectrum. In addition, it is still unclear that users are willing to pay the additional upfront cost for a reduction in service costs downstream. Ericsson is pioneering wireless PBXs, and the results of its experiences will substantially determine the fate of the market for these products. Nonetheless, there has been a great deal of attention focused on this concept, and optimistic forecasts estimate that wireless PBXs could account for 30 percent of PBX sales by 1997.

Computer-switch technologies represent significant growth areas for PBX as well as computer manufacturers. Applications for these technologies, which are currently available only to very larger users through costly customized offerings, are being deployed to improve call center applications. These technologies enhance the productivity of customer service operations, fund-raising centers, telemarketing operations, and other operations in which business is conducted over the telephone. Apart from call centers, computer-switch technologies hold great potential for security systems, workforce management systems, and numerous other applications.

Users, systems integrators, computer companies, PBX manufacturers, and carriers are all looking forward to enormous growth in this market segment. One great impediment to the delivery of these technologies, however, is the absence of clear standards. Without clear

Figure 40

1990 Vendor Control of Installed PBX Customer Base



1990 Total Installed Base = 25.2 Million Lines

Source: NATA Market Research Department

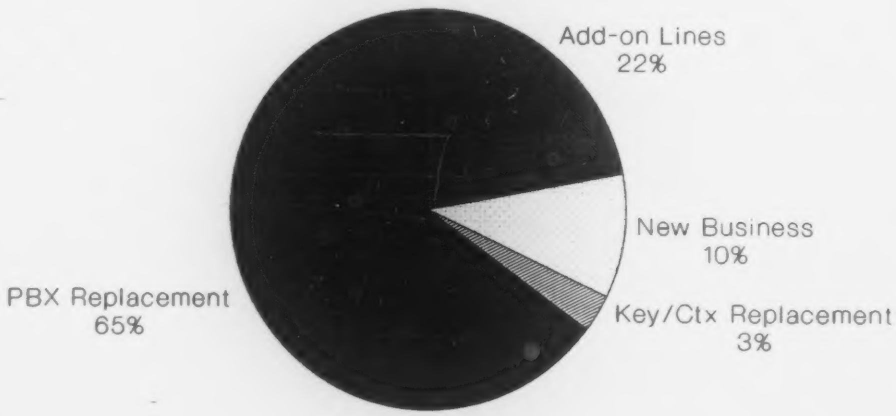
standards, applications for computer-switch technologies must be customized for each customer and combination of PBXs and host computers — with estimated costs for software development alone of $150,000-$300,000 per application.

Until software developers can work with standard interfaces, the "killer applications" that can deliver the benefits of these technologies to the general business market are unlikely to emerge. Assuming a single standard is established for these interfaces, analysts anticipate the market for computer-switch applications will exceed that for imaging, already assessed in billions of dollars.

The AT&T dumping case is another development that has had an impact on the market shares of PBX manufacturers, especially of the small systems. To avoid the duty that certain equipment from Japan, Korea, and Taiwan has been assessed, some foreign-owned producers have set up manufacturing in the United States and will be able to avoid dumping duties as a result. A more detailed description of the proceeding is discussed in the section on foreign trade. In addition, an analysis of the effect on the key system market is discussed in the key/hybrid section of this report.

Figure 41

1990 PBX Shipments by Type of Installation

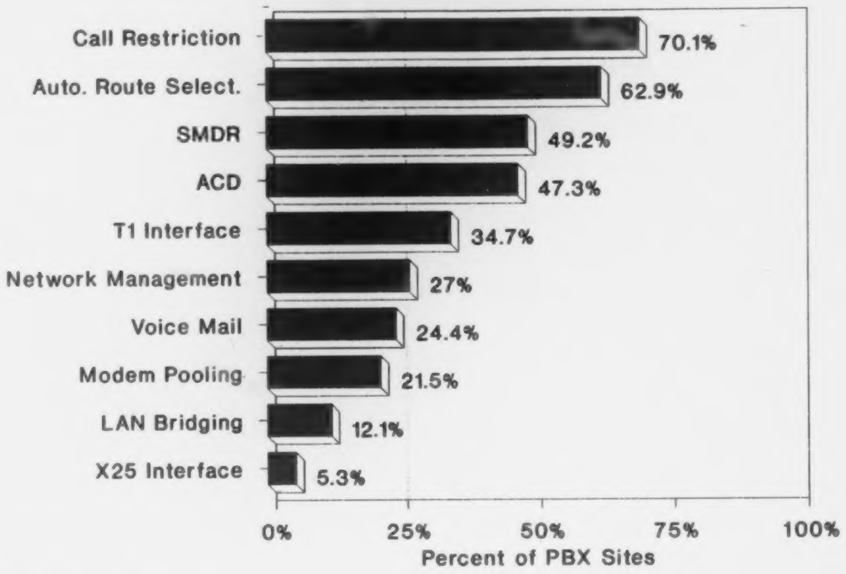


1990 Total PBX Lines Shipped - 3,990,000

Source: NATA Market Research Department

Figure 42

PBX Feature Usage



Source: TFS, Inc., Westford, Massachusetts

Table 20

PBX Sales by System Size, 1984-1995

	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*	1990	(p) 1991	(p) 1992	(p) 1993	(p) 1994	(p) 1995	1990-95 Percent CAGR*
1-99 Lines per System:														
Lines: thousands	948	1,069	1,076	1,086	1,110	1,102	3.1	1,025	1,031	1,050	1,165	1,135	1,160	2.5
Systems: thousands	16.3	18.4	18.5	18.7	19.1	19.0	3.1	17.6	17.7	17.9	19.9	19.4	20.3	2.9
Avg. Lines per System	58.1	58.1	58.2	58.2	58.2	58.3		58.3	58.4	58.4	58.5	58.5	57.3	
100-399 Lines per System:														
Lines: thousands	1,061	1,157	1,118	1,127	1,173	1,097	0.7	1,075	1,080	1,110	1,210	1,225	1,275	3.5
Systems: thousands	6.8	7.4	7.1	7.2	7.5	7.0	0.6	6.8	6.9	7.1	7.7	7.8	8.2	3.8
Avg. Lines per System	157.0	157.0	157.0	157.0	157.1	157.1		157.1	157.1	157.2	157.3	157.3	156.0	
400-100 Lines per System:														
Lines: thousands	834	907	911	919	1,011	1,004	3.8	1,010	995	1,005	1,204	1,430	1,490	8.1
Systems: thousands	1.3	1.4	1.4	1.4	1.6	1.6	4.2	1.6	1.5	1.6	1.9	2.2	2.4	8.4
Avg. Lines per System	644.5	644.5	644.5	644.5	644.4	644.4		644.4	644.4	644.5	644.5	644.5	643.0	
1000+ Lines per System:														
Lines: thousands	947.0	982.0	1035.0	1043.0	1025.0	998.0	1.1	895	919	1,170	1,411	1,340	1,475	10.5
Systems: thousands	0.3	0.3	0.3	0.4	0.3	0.3	**	0.3	0.3	0.4	0.5	0.4	0.4	5.9
Avg. Lines per System	2,975.3	2,975.2	2,975.2	2,975.1	2,975.0	2,975.0		2,990.0	2,992.0	2,995.0	2,995.0	2,995.0	2,985.0	
Total:														
Lines: thousands	3,790	4,115	4,140	4,175	4,319	4,201	2.1	4,005	4,025	4,335	4,990	5,130	5,400	6.2
Systems: thousands	24.7	27.5	27.3	27.7	28.5	27.9	2.5	26.3	26.4	27.8	29.9	30.2	31.6	3.7
Avg. Lines per System	153.4	149.6	151.6	150.7	151.5	151.1		151.7	152.5	161.3	166.9	170.0	170.9	
Value: millions	$2,843	$3,086	$3,105	$3,050	$2,928	$2,875	0.2	$2,590	$2,552	$2,787	$3,219	$3,285	$3,400	5.6
Avg. price per line: dollars	$750	$750	$750	$731	$678	$679	-2.0	$649	$634	$640	$645	$640	$630	-0.6

* Compound Annual Growth Rate
** Less than .05 Percent
(p) Projection

Source: NATA Market Research Department

Table 21

PBX Installed Base and Annual Sales for the Top Metropolitan Areas
1985, 1990, and 1995

City	PBX Installed Base In No. of Systems			Annual PBX Shipments In No. of Systems		
	1985	1990	1995	1985	1990	1995
Atlanta	1,702	2,052	2,252	255	308	338
Baltimore	1,416	1,554	1,609	212	233	241
Boston	3,357	4,012	4,346	503	601	651
Chicago	6,698	7,359	7,754	1,004	1,103	1,163
Cincinnati	1,162	1,320	1,384	174	198	208
Cleveland	1,815	1,955	2,004	272	293	300
Columbus	881	1,028	1,099	132	154	164
Dallas/Ft. Worth	3,157	4,189	4,561	473	628	684
Denver	1,655	2,033	2,291	248	304	343
Detroit	3,002	3,333	3,757	450	499	563
Houston	3,118	3,051	3,123	467	455	502
Indianapolis	950	1,088	1,135	142	163	170
Kansas City	1,229	1,381	1,450	184	207	217
Los Angeles	7,469	8,371	8,922	1,120	1,255	1,338
Miami	1,473	1,649	1,748	220	247	262
Milwaukee	1,323	1,447	1,514	198	217	227
Minneapolis/St. Paul	2,311	2,762	3,003	346	414	450
New Orleans	1,027	1,116	1,169	154	167	175
New York	7,395	7,917	8,237	1,109	1,187	1,235
Oklahoma City	739	870	946	110	130	141
Phoenix	1,223	1,660	1,932	183	249	289
Pittsburgh	1,539	1,678	1,736	230	251	260
Portland	1,072	1,294	1,426	160	194	213
Philadelphia	3,552	3,916	4,086	532	587	612
St. Louis	1,989	2,231	2,337	298	334	350
San Diego	1,131	1,416	1,575	169	212	236
San Francisco	2,757	3,137	3,373	413	470	505
San Jose	1,095	1,414	1,583	164	212	237
Seattle	1,351	1,657	1,808	202	248	271
Washington	2,337	2,704	2,895	350	405	434

Source: NATA Market Research Department

Table 22

PBX-Centrex Installed Base Development, 1984-1995

- - - - - - - - - - - Thousands of Lines - - - - - - - - - -

	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*
1-99 Lines per System:							
PBX	5,484	5,794	5,851	6,077	6,085	5,985	1.8
Centrex	925	935	957	1,129	1,214	1,325	7.5
100-399 Lines per System:							
PBX	6,142	6,489	6,826	7,343	7,510	7,292	3.5
Centrex	827	840	834	902	972	998	3.8
400-1000 Lines per System:							
PBX	4,825	5,099	5,607	5,824	5,956	6,035	4.6
Centrex	1,426	1,440	1,544	1,441	1,550	1,495	0.9
1000+ Lines per System:							
PBX	5,483	5,794	6,095	6,070	6,346	5,833	1.2
Centrex	3,875	3,925	4,020	4,053	4,364	4,405	2.6
TOTAL:							
PBX	21,934	23,176	24,379	25,314	25,897	25,145	2.8
Centrex	7,053	7,140	7,355	7,525	8,100	8,223	3.1

- - - - - - - - - - - Thousands of Lines - - - - - - - - - -

	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 Percent CAGR*
1-99 Lines per System:							
PBX	5,860	6,081	6,328	6,530	6,680	6,830	3.1
Centrex	1,424	1,514	1,745	1,875	2,055	2,290	10.0
100-399 Lines per System:							
PBX	7,308	7,332	7,412	7,505	7,590	7,700	1.1
Centrex	1,036	1,099	1,205	1,490	1,562	1,635	9.6
400-1000 Lines per System:							
PBX	6,048	6,166	6,323	6,625	6,880	7,300	3.8
Centrex	1,505	1,515	1,545	1,680	1,815	1,960	5.4
1000+ Lines per System:							
PBX	5,984	6,232	6,486	6,748	7,020	7,370	4.3
Centrex	4,651	4,752	5,700	6,160	6,530	7,050	8.7
TOTAL:							
PBX	25,200	25,811	26,549	27,408	28,170	29,200	3.0
Centrex	8,616	8,880	10,195	11,205	11,962	12,935	8.5

* Compound Annual Growth Rate
(p) Projection

Source: NATA Market Research Department

Table 23

PBX-Centrex Lines in Place by Regional Bell Operating Company, 1986-1990

	1986	1987	1988	1989	1990	1986-90 Percent
	Thousands of Lines					CAGR*
Ameritech						
PBX	2,857	2,986	3,002	3,025	3,175	2.7
Centrex	1,020	1,185	1,350	1,575	1,720	14.0
Bell Atlantic						
PBX	4,085	4,269	4,390	4,375	4,469	2.3
Centrex	1,375	1,480	1,550	1,675	1,810	7.1
BellSouth						
PBX	3,120	3,406	3,485	3,365	3,475	2.7
Centrex	450	675	785	795	810	15.8
NYNEX						
PBX	3,320	3,530	3,610	3,505	3,575	1.9
Centrex	957	1,027	1,075	1,105	1,195	5.7
PACTEL						
PBX	3,025	3,067	3,150	3,040	3,173	1.2
Centrex	875	935	950	960	960	2.3
SW Bell						
PBX	3,300	3,420	3,575	3,835	4,076	5.4
Centrex	250	300	325	375	450	15.8
US WEST						
PBX	1,990	2,045	1,936	1,234	1,485	-7.1
Centrex	477	596	675	732	990	20.0
TOTAL						
PBX	21,697	22,723	23,148	22,379	23,428	1.9
Centrex	5,404	6,198	6,710	7,217	7,935	10.1

* Compound Annual Growth Rate

Source: NATA Market Research Department

Table 24

1989 PBX-Centrex Penetration by Industry

	Percent of Installed PBX Lines	Percent of Installed Centrex Lines
	Percent	
Banking/Finance	15	5
Engineering/Legal/Management	15	12
Government	2	27
Health/Education	7	15
Insurance	3	3
Manufacturing	17	15
Retail Trade	10	8
Transportation/Utilities	10	3
Wholesale	12	7
Other	9	5
Total	100	100

Source: Gartner Group

Table 25

PBX Prices per Line by System Size, 1984-1995

System	1984	1985	1986	1987	1988	1989	1984-89 CAGR*
	- - - -	- - - -	- - - -	dollars per	line - - -	- - -	(Percent)
1-99 Line System	650	625	600	575	535	500	-5.1
100-399 Line System	810	775	750	720	650	650	-4.3
400-1000 Line System	935	910	835	780	745	740	-4.6
1000+ Line System	950	925	900	860	820	810	-3.1
Average	750	750	750	731	678	679	-2.0

System	1990	1991	1992	1993	1994	1995	1990-95 CAGR*
	- - - -	- - - -	- - - -	dollars per	line - - -	- - -	(Percent)
1-99 Line System	595	560	555	550	560	560	-1.2
100-399 Line System	645	630	625	623	625	620	-0.8
400-1000 Line System	740	735	735	740	740	730	-0.3
1000+ Line System	810	805	800	845	835	820	0.2
Average	649	634	640	645	640	630	-0.6

* Compound Annual Growth Rate
(p) Projection

Source: NATA Market Research Department

Table 26

Estimated Revenue for Major PBX Manufacturers, 1986-1990

($ millions)

	1986	1987	1988	1989	1990
AT&T	460	450	400	390	400
Northern Telecom	385	345	335	340	380
IBM/ROLM	265	265	300	290	280
NEC	150	145	135	130	125
Mitel	110	90	100	110	105
Siemens	90	85	95	100	100
Intecom/Wang	45	40	35	30	25
Fujitsu	25	60	65	60	50

Source: Washington *Post*, August 11, 1989, and NATA Market Research Department

Table 27

1990 PBX Manufacturer Market Shares by Lines Shipped, by System Size
(percent)

	1-99	100-399	300-999	1000+	Average
AT&T	20	25	25	27	25
Northern Telecom	25	24	19	25	22
ROLM/IBM	8	12	17	20	14
Mitel	16	8	2	3	6
NEC	6	8	10	8	8
Siemens	6	5	2	3	4
Fujitsu	*	5	6	1	3
Alcatel/ITT	3	5	1	*	2
Intecom/Wang	*	*	*	10	2
Others	16	8	18	3	14
Total	100	100	100	100	100

* Less than 1 percent

Source: NATA Market Research Department

Table 28

PBX Shipments by Manufacturer Distribution Channels, 1986-1990

	1986		1987		1988		1989		1990	
	Lines (000)	Share (percent)	Lines (000)	Share (percent)	Lines (000)	Share (percent)	Lines (000)	Share (percent)	Lines (000)	Share (percent)
Manuf. Direct*	2087	50.4	2242	53.7	2328	53.9	2311	55.0	2210	55.2
Interconnect	998	24.1	1044	25.0	1028	23.8	916	21.8	858	21.4
Wholesale Supply Houses	404	9.8	225	5.4	255	5.9	260	6.2	243	6.1
Bell Operating Co.	479	11.6	518	12.4	544	12.6	542	12.9	519	13.0
Independent Operating Companies	172	4.2	146	3.5	164	3.8	172	4.1	175	4.4
Total	4140	100	4175	100	4319	100	4201	100	4005	100

* Includes wholly-owned distributor networks.

Source: NATA Market Research Department

Key/Hybrid Telephone System Market

Introduction

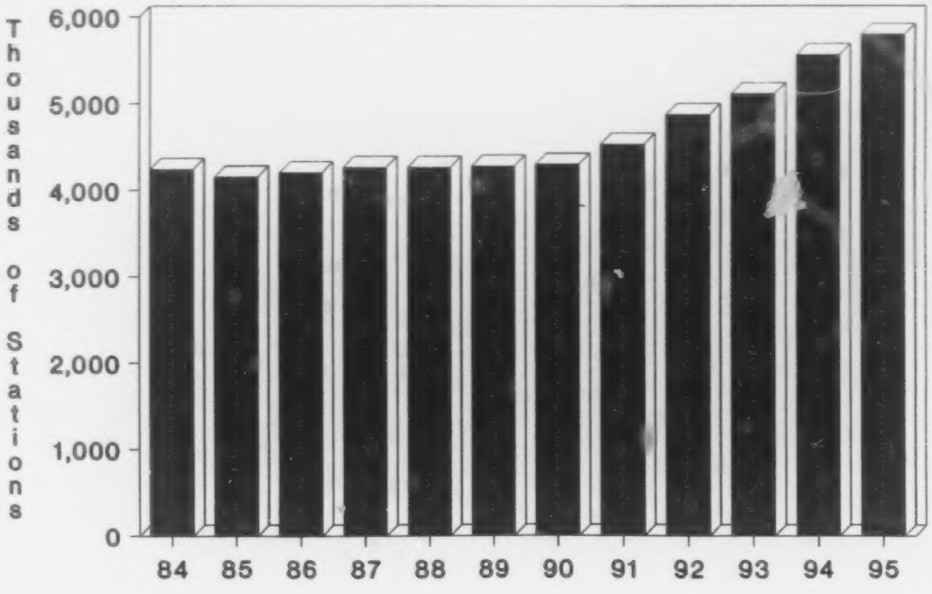
Key telephone systems are multi-line business communications systems providing users with shared access to a group of external telephone lines through buttons or keys located on the telephone set. Typically, each key is associated with a specific outside line, and that line's number appears on the key. When a user presses a key and lifts the telephone receiver off-hook, a circuit is completed and the user receives a dial tone from the telephone company's central office (CO). The buttons on a key telephone generally light up and flash to indicate the status of the line to which the phone is connected. For example, an unlit button indicates an idle line; a slow flash indicates an incoming call; a fast flash indicates a call on hold; and a steady light indicates the line is in use. This type of network access is referred to as direct line termination, as each incoming line is connected directly to a specific key on the telephone set.

Key systems primarily provide voice communications for small to medium-sized offices — those requiring from 2 to 120 station sets. These systems provide intra-office communications links (intercom), shared access to the public switched telephone network and long-distance networks, and limited office-automation functions (such as call accounting).

Key systems can serve either as stand-alones or as adjuncts to larger PBX systems or centrex offerings. As a stand-alone, the key/hybrid, acting as the primary telecommunications system within a small business or branch

Figure 43

Total Key Station Shipments, 1984-1995



Source: NATA Market Research Department

office, is connected directly to the local telephone company central office. As an adjunct, the key system is installed alongside a PBX or centrex system. This configuration provides users with access to those switching systems' enhanced features and affords greater ease of use than standard single-line telephone sets. About 30 percent of the installed base of key/hybrid systems are used in conjunction with either a PBX or with centrex.

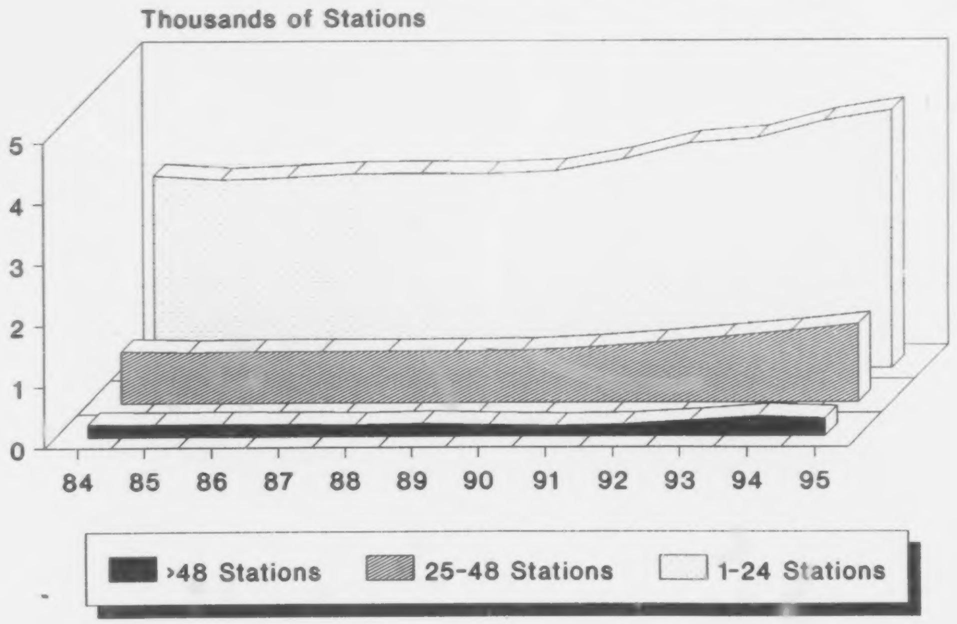
Key systems have evolved from electromechanical devices to electronic systems employing solid state integrated circuits and microprocessors. Introduced in the late 1970s, hybrid key systems are the most recent variety. The designation "hybrid" refers to the key system's ability to provide direct-line-terminated, one-button-per-line network access typical of traditional key systems, or the "dial" pooled access characteristic of PBX systems — with some able to provide both types of network access simultaneously to different station sets.

Typical features of a modern hybrid key system include call restriction, system speed dialing, system administration, night service, emergency power, and station message detail recording. At the other end of the spectrum, key systems without a KSU (key service unit) are becoming increasingly popular, particularly in small businesses, due to their ease of installation and their decentralized configuration.

As the implementation of ISDN progresses, more and more manufacturers offer end-to-end digital key systems to complement their analog product offerings. One reason is that all-digital systems support modemless data communications capability. In addition, wireless and cord-

Figure 44

Key/Hybrid Station Shipments by Type, 1984-1995



Source: NATA Market Research Department

less key systems are attracting attention. With wireless systems, the station sets are connected to the KSU by radio waves rather than by wire. With cordless units, the station sets themselves have cordless handsets that communicate with the station base unit. AT&T introduced a cordless key system at year-end 1989 which has attracted considerable attention.

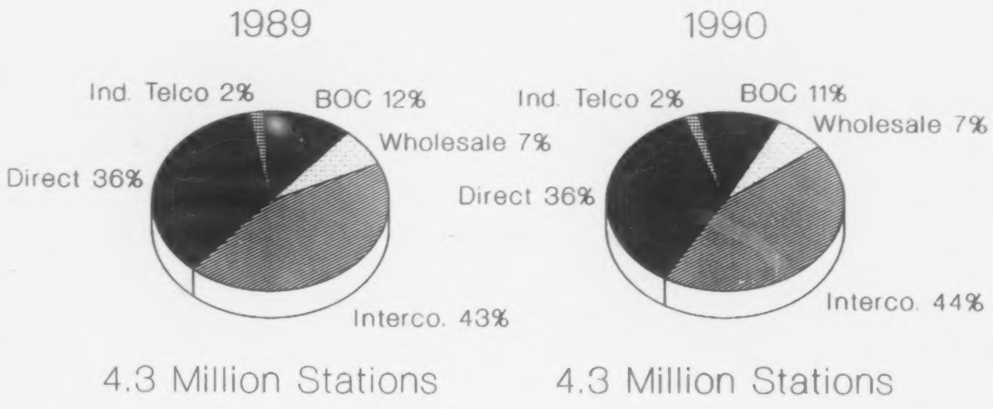
Market Review

The key system market increased slowly from just under 4.2 million stations valued at $955 million in 1985 (Table 29, page 122) to 4.3 million stations valued at $1.0 billion in 1989 and leveling off at 4.3 million stations valued at slightly over $1.0 billion in 1990 (Fig. 43, page 114). It is anticipated that the growth of the market will accelerate somewhat in the next few years and amount to 5.8 million stations valued at $1.3 billion in 1995. The market is currently characterized by a relatively large number of suppliers competing for market share. Profit margins have been slim, so vendors of key systems are beginning to market the products creatively. One aspect of this creativity has been the growth in key systems used in conjunction with centrex, especially by smaller users. Growth of the market for the smallest line-size segment — 1 to 24 stations — is expected to increase the fastest between now and 1995 (Fig. 44, page 115).

One of the dramatic developments of 1990 was the increase in Northern Telecom's share of the key system market. With Norstar, a feature rich, user friendly product and aggressive pricing and marketing techniques, Northern Telecom has grown from an also-ran to a major player with 10 percent of the market in 1990. Part of Northern's success is due to its distribu-

Figure 45

Key/Hybrid Shipments by Distribution Channel, 1989-1990



Source: NATA Market Research Department

tion strategy. The company has signed some type of distribution agreement with virtually every RBOC as well as with many independents. In addition, it has a direct sales force for national accounts and utilizes interconnects for the balance of its distribution requirements. The company's plan is to hold over 20 percent of the market within the next several years.

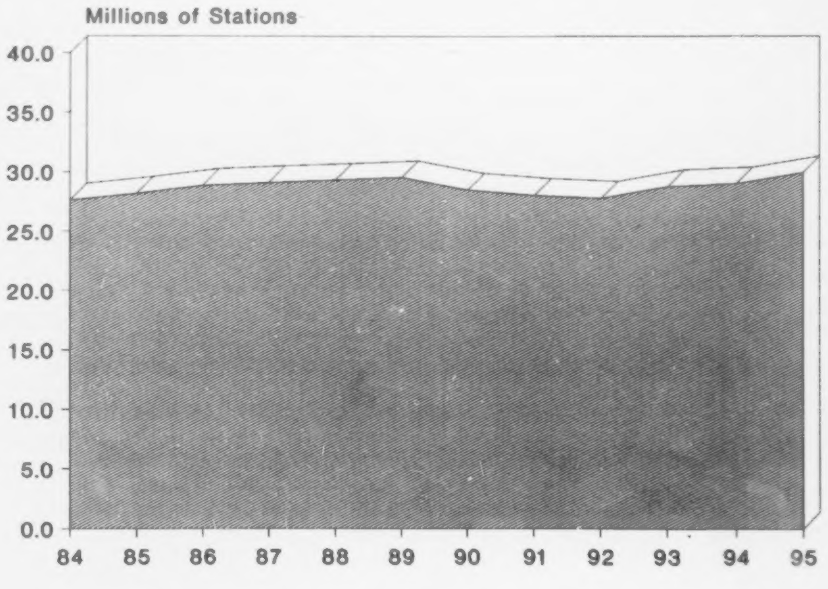
In general, manufacturers of key systems are increasingly selling directly to end users by acquiring interconnect companies. TIE alone has acquired over 40 interconnect companies in the last several years. Manufacturers' direct sales (including wholly-owned distribution networks) increased from 1.3 million stations in 1986 (31.1 percent of the market) to 1.6 million stations in 1990 (37.0 percent of the market). Sales by independent CPE distributors remained relatively stable at approximately 1.9 million stations (44.9 percent of the market in 1986 and 43.5 percent of the market in 1990). Distribution through RBOCs decreased somewhat while distribution through wholesale supply houses and independent telephone companies increased slightly from 1989 to 1990. (Table 30, page 123, and Fig. 45, page 116).

Installed Base

The installed base of key and hybrid key systems in the U.S. increased from 27.6 million stations in 1984 to 28.5 million stations in 1990 and is expected to increase to 30.0 million stations by 1995 (Table 31, page 123, and Fig. 46). In terms of systems, the installed base increased from 5.1 million in 1984 to 5.3 million in 1989 before decreasing to 5.0 million in 1990. It is expected to amount to 5.1 million in 1995.

Figure 46

Key/Hybrid Installed Base, 1984-1995

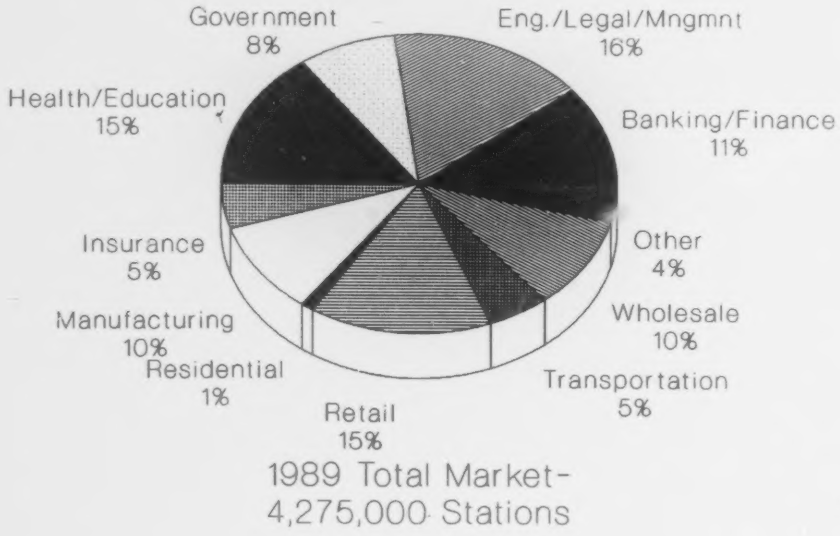


Source: NATA Market Research Department

As for industry penetration, the single most significant market for key systems is the engineering/legal/management services market, accounting for 16 percent of all key systems sold in 1989 (Table 32, page 124, and Fig. 47). Health/education and retail markets were close seconds, each with 15 percent of the market.

Figure 47

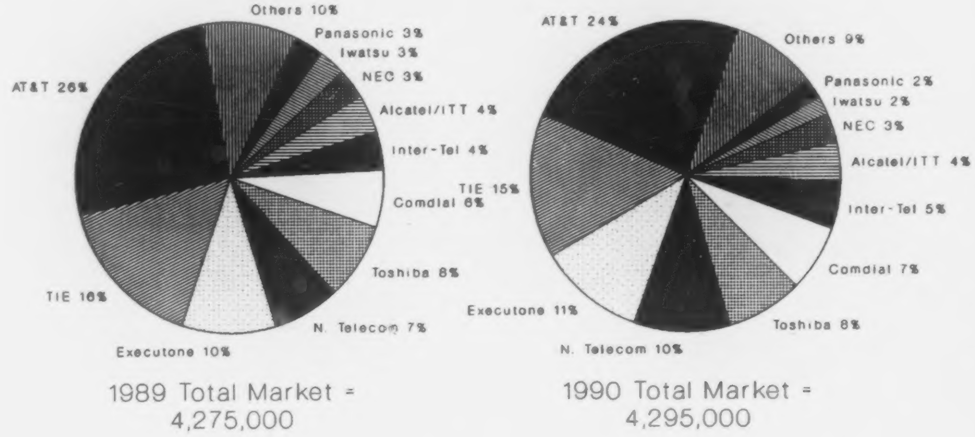
1989 Key System Market by Industry



Source: Gartner Group

Figure 48

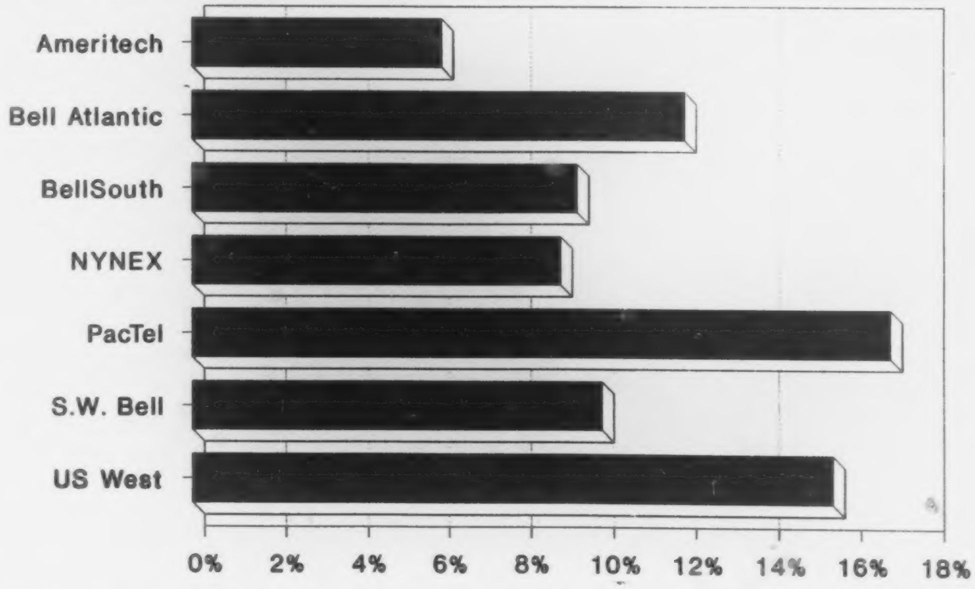
Key/Hybrid Manufacturer Market Share of Stations Shipped, 1989-1990



Source: NATA Market Research Department

Figure 49

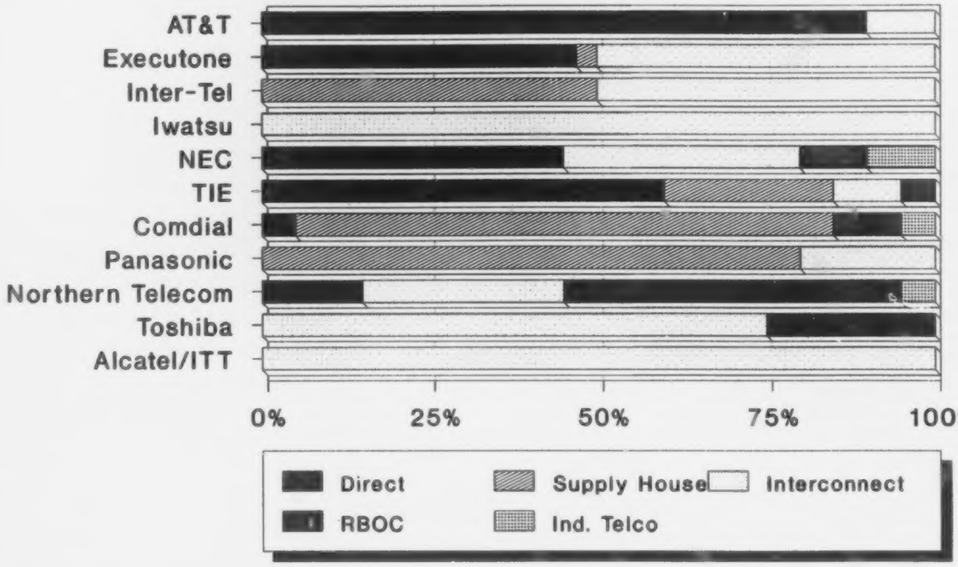
1990 RBOC Share of Key Systems Market Within Own Region



Source: NATA Market Research Department

Figure 50

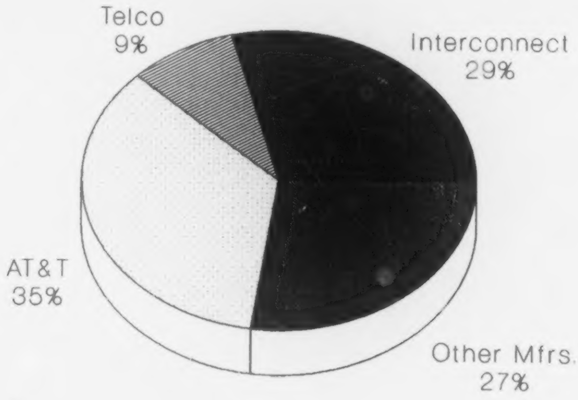
1990 Key System Distribution Channels by Company



Source: NATA Market Research Department

Figure 51

1990 Vendor Control of Key/Hybrid Installed Base

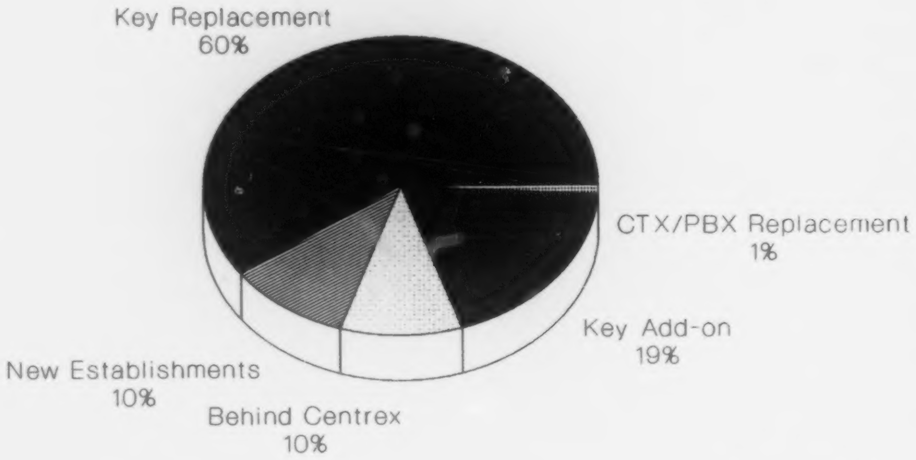


1990 Total Installed Base = 28.5 Million Stations

Source: NATA Market Research Department

Figure 52

1990 Key/Hybrid Shipments by Type of Installation



Source: NATA Market Research Department

Table 29

Key Systems Market, 1984-1995

	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*
1-24 Stations per System:							
Stations: thousands	3180	3113	3149	3209	3214	3207	0.2
Systems: thousands	432.9	423.7	433.9	436.6	440.4	440.4	0.3
Avg. Stations per System	7.3	7.3	7.3	7.3	7.3	7.3	
25-48 Stations per System:							
Stations: thousands	848	830	840	845	846	851	0.1
Systems: thousands	28.8	28.2	28.5	28.6	28.6	28.3	-0.3
Avg. Stations per System	29.4	29.4	29.5	29.5	29.6	30.0	
49+ Stations per System:							
Stations: thousands	212	207	210	205	200	217	0.5
Systems: thousands	4.2	4.1	4.2	4.1	4.0	4.3	0.5
Avg. Stations per System	50.2	50.2	50.2	50.2	50.1	50.3	
Total:							
Stations: thousands	4240.0	4150.0	4199.0	4259.0	4260.0	4275.0	0.2
Systems: thousands	465.9	456.0	466.6	469.3	473.0	473.0	0.3
Avg. Stations per System	9.1	9.1	9.0	9.1	9.0	9.0	
Value: $ millions	$1,039	$955	$957	$960	$965	$995	-0.9

	1990	1991	1992	1993	1994	1995	1990-95 Percent CAGR*
1-24 Stations per System:							
Stations: thousands	3250	3439	3701	3781	4059	4230	5.4
Systems: thousands	439.2	463.3	493.7	514	558.4	574.7	5.5
Avg. Stations per System	7.4	7.4	7.5	7.4	7.3	7.4	
25-48 Stations per System:							
Stations: thousands	854	905	974	1073	1168	1275	8.3
Systems: thousands	28.4	30.2	32.6	35.9	39.1	42.5	8.4
Avg. Stations per System	30	30	29.9	29.9	29.9	30	
49+ Stations per System:							
Stations: thousands	191	181	195	256	333	290	8.7
Systems: thousands	3.8	3.6	3.9	5.1	6.6	5.8	8.8
Avg. Stations per System	50.2	50	50.1	50.2	50.2	50.2	
Total:							
Stations: thousands	4295.0	4525.0	4870.0	5110.0	5560.0	5795.0	6.2
Systems: thousands	471.4	497.1	530.2	555.0	604.1	623.0	5.7
Avg. Stations per System	9.1	9.1	9.2	9.2	9.2	9.3	
Value: $ millions	$1,025	$1,100	$1,125	$1,175	$1,250	$1,275	4.5

* Compound Annual Growth Rate

(p) Projection

Source: NATA Market Research Department

Table 30

Key/ Hybrid Shipments by Manufacturer Distribution Channel, 1986-1990

	1986		1987		1988		1989		1990	
	Stations (000)	Share (percent)	Stations (000)	Share (percent)	Stations (000)	Share (percent)	Stations (000)	Share (percent)	Stations (000)	Share (percent)
Manuf. Direct	1,307	31.1	1,419	33.3	1,457	34.2	1,560	36.5	1,589	37.0
Interconnect	1,877	44.7	1,913	44.9	1,926	45.2	1,838	43.0	1,868	43.5
Wholesale Supply Houses	343	8.2	275	6.5	290	6.8	295	6.9	301	7.0
Bell Operating Co.	466	11.1	562	13.2	532	12.5	517	12.1	472	11.0
Independent Telco	206	4.9	90	2.1	55	1.3	65	1.5	65	1.5
Total	4199	100	4259	100	4260	100	4275	100	4295	100

Source: NATA Market Research Department

Table 31

Installed Base of Key/Hybrid Market, 1984-1995

	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*
Total Stations: thousands	27625	28186	28874	29105	29325	29566	1.4
Total Systems: thousands	5085	5151	5259	5197	5237	5280	0.8
Average Stations/Systems	5.4	5.5	5.5	5.6	5.6	5.6	0.7

	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 Percent CAGR*
Total Stations: thousands	28492	28043	27800	28778	28996	29917	1.0
Total Systems: thousands	5000	4920	4877	4961	5000	5071	0.3
Average Stations/Systems	5.7	5.7	5.7	5.8	5.8	5.9	0.7

* Compound Annual Growth Rate
(p) Projection

Source: NATA Market Research Department

Table 32

1989 Key System Market Penetration by Industry

	Percent
Banking/Finance	11
Engineering/Legal/Management	16
Government	8
Health/Education	15
Insurance	5
Manufacturing	10
Residential	1
Retail	15
Transportation	5
Wholesale	10
Other	4
Total	100

Source: Gartner Group

Table 33

Key/Hybrid Manufacturer Market Shares by Stations Shipped 1988-1990

	1988	1989	1990
	- - - -	Percent	- - - -
AT&T	26	26	24
TIE	18	16	15
Executone	10	10	11
Northern Telecom	1	7	10
Toshiba	9	8	8
Comdial	4	6	7
Inter-Tel	5	4	5
Alcatel/ITT	3	4	4
NEC	3	3	3
Iwatsu	3	3	2
Panasonic	3	3	2
Others	15	10	9
Total	100	100	100

Source: NATA Market Research Department

Data Communications Equipment Market

Introduction

Data communications represents the overlap between data processing and traditional communications. As the technologies of the two industries have merged, so have applications of the technologies. With the proliferation of computers has come the concept of distributed processing. Traditionally, most computers have been of the mainframe type and users typically have had access through "dumb" terminals capable only of displaying stored information. If the terminal were not at the same location as the mainframe, a modem was necessary for communications through the telecommunications network. As computer technology has evolved and with more and more memory and processing has become available from smaller and smaller machines, mini and personal computers have been developed. Today, data processing is often performed away from the mainframe, leaving the mainframe free to manage extremely large data bases or to perform very complex data processing tasks.

The tremendous growth in distributed processing and computers in general has caused the data communications market to grow rapidly. In addition, a large and growing market has developed for value added networks (VANs) such as those used for credit card validation, electronic funds transfer, electronic mail, etc., that are having a significant impact on the demand for data communications equipment. Of the numerous types of data communications equipment, those addressed here include modems, multiplexers, packet switching equipment, front-end processors, concentrators, and network controllers.

Modems, developed in the early 1960s, are among the oldest of data communications products. The word "modem" is a contraction of modulator/demodulator. Modems interface computers with the telephone network. The modem converts the transmitting computer's binary or digital code into a form that can be transmitted by telephone line using analog or audio-frequency shift keying tones. At the receiving end a second modem converts the signal back to its binary format. Modems can be made to operate at different speeds, depending upon the system architecture at either end.

Multiplexers are devices that interweave several communications signals or channels to increase the capacity of a telecommunications network. This interweaving can be done either by frequency division, in which each channel is allocated a different frequency within the wideband carrier, or by time division, in which each channel consists of a series of pulses, interleaved on a time-sharing basis. One of the more prevalent types of multiplexer is the T1. This device multiplexes channels through a T1 (1.544 megabits per second) circuit, a high capacity, time-multiplexed transmission pipeline. The T1 circuit is being used increasingly to interconnect telephone company central offices and to provide private voice and data networks, video transmission, long distance communications, etc., in any situation where high capacity and speed are necessary. Another advantage of T1 networks is their compatibility with digital PBXs, packet switching nodes, and asynchronous terminals.

Packet switches are also devices that increase the capacity of telecommunications networks by enabling a single channel to be used for multiple concurrent transmissions. This can be accomplished because the data to be transmitted to different destinations is formed into packets to which electronic addresses are assigned. The data is then sent as a continuous stream and switched to appropriate destinations by means of a packet switch. Packet switches are efficient for "bursty" high-speed data communications because lines are tied up only while data is transmitted. By contrast, circuit switching maintains an open connection even when no information is being transmitted. Data transmission over a packet-switched network can be at least 50 percent cheaper than over normal circuit-switched telephone lines. Packet switching networks are becoming very popular due to their use in VANs.

Front-end processors are auxiliary computers attached to a network to perform control operations, freeing up the host computer for data processing. Increasingly, software for the front-end processor is being developed that allows support of multiple host-computers, network diagnostics, and protocol conversion.

Concentrators are devices that perform a function similar to both multiplexers and packet switches in the sense that they are designed to maximize the capacity of a given telecommunications transmission circuit. Concentrators can be of several different types. One popular type is a compression concentrator, which compresses the data by reducing the number of bits required to represent a character or a whole block of data, so the user gains more transmission bandwidth.

LANs are dedicated data communications facilities providing high-speed switched connections, generally over a distance of less than a few miles, typically within a building or a campus environment. Essentially, a LAN is a specialized private data network, designed to provide high-speed, high-bandwidth data transmission among a number of different types of data terminal equipment. LANs consist of a transmission medium, a network controller and a LAN gateway for interaction with the public network.

Market Review

The data communications market has increased rapidly over the last several years from $3.2 billion in 1984 to $8.8 billion in 1990 and is expected to reach $10.9 billion by 1995 (Table 34, page 128, Fig. 53, page 127). Part of the increase in sales of data communications equipment can be attributed to increasing sales by interconnect companies. In an effort to increase profitability and customer satisfaction, interconnects have begun to broaden the scope of their product and service offerings.

The market for modems grew at a rather healthy rate during 1984 to 1990, but is expected to level off in the future as the implementation of all-digital networks obviates the use of modems. It will be many years, however, before the entire telecommunications network is digital. In the meantime, the proliferation of personal computers, especially in the home, will keep the demand for modems at a moderate level.

Products that maximize the capacity of a network, such as multiplexers, packet switching equipment, and concentrators, have recently become important as users begin to demand high speed data lines for the development of new data networks. Systems managers need to ensure that the network has the capacity to allow continued growth of these new telecommunications services.

The market for multiplexers grew steadily from $550 million in 1984 to $1.2 billion in 1990. Growth is expected to continue in the next several years to reach $1.6 billion by 1995. This rise will result from increased use of T1 networks for data and voice transmission and ultimately for ISDN.

Largely as a result of VANs, the market for packet switching equipment has increased from $225 million in 1984 to $1.2 billion in 1990 and is expected to exceed $1.6 billion in

1995. The market for concentrators has increased from $165 million in 1984 to $250 million in 1990 and is expected to increase to $260 million by 1992. The implementation of ISDN will reduce demand after this point, and the market is expected to turn downward to $235 million in 1995.

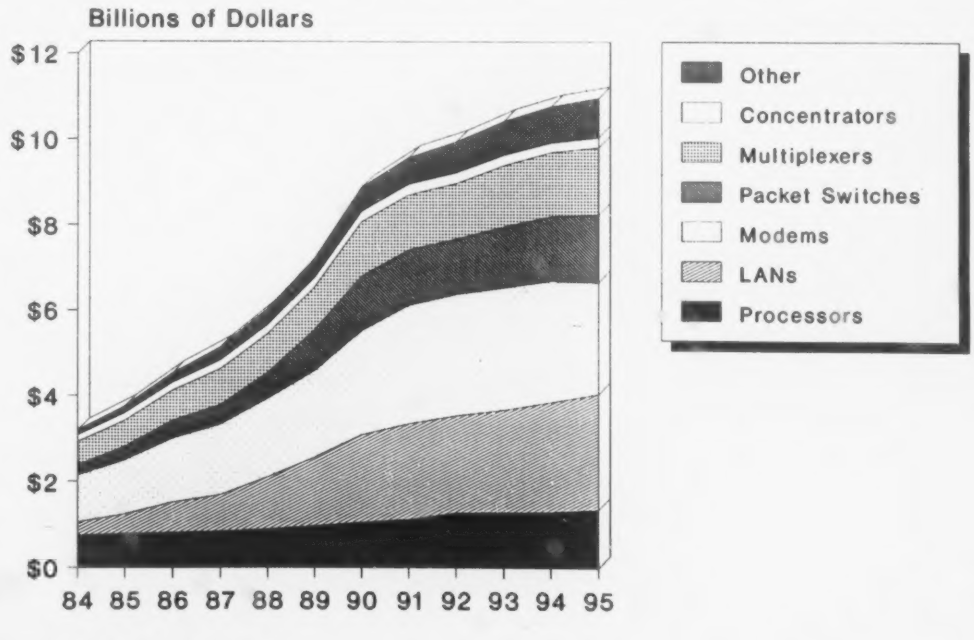
As communication to and between mainframe computers becomes commonplace, front-end processors will often be required to sort out the protocols and other aspects of communications. The market for these devices increased moderately from $751 million in 1984 to $1.1 billion in 1990, and is expected to be over $1.4 billion by 1995.

Likewise, as the demand for communications between personal computers grows stronger, LANs will become more popular, particularly for intra-office communications. The market for LANs increased from $300 million in 1984 to $2.0 billion in 1990 and is expected to grow to $2.7 billion by 1995.

Channels of distribution for data communication products vary by type of product. Types of channels include computer dealers (independent and chain), systems integrators, manufacturer direct sales forces, wholesale supply houses, interconnects, value added resellers, value added distributors, and mail order houses. Because data communications represents the middle ground between data processing and voice communications, it is sold by distributors of both types of products. In general, though, products such as front end processors used expressly with computers are sold more often through computer-oriented outlets, while T1 multiplexers used for voice communications might very well be sold by interconnects.

Figure 53

Data Communications Equipment Market, 1984-1995



Source: NATA Market Research Department

Table 34

Data Communications Equipment Market, 1984-1995

Equipment	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*
	millions of dollars						
Front-end processor	751	790	815	845	896	965	5.1
Local area networks	300	450	700	840	1,200	1,590	39.6
Modems	1,100	1,266	1,500	1,650	1,840	2,035	13.1
Packet switching equipment	225	305	410	452	601	950	33.4
Multiplexers	550	613	700	840	910	1,005	12.8
T-1 multiplexers	80	150	174	275	340	615	50.4
Concentrators	165	180	197	209	219	230	6.9
Other	100	150	210	290	360	430	33.9
Total	3,191	3,754	4,532	5,126	6,026	7,205	17.7

Equipment	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 Percent CAGR*
	millions of dollars						
Front-end processor	1,055	1,125	1,275	1,282	1,295	1,350	5.1
Local area networks	2,020	2,210	2,251	2,375	2,550	2,685	5.9
Modems	2,450	2,785	2,850	2,875	2,850	2,625	1.4
Packet switching equipment	1,275	1,295	1,300	1,430	1,502	1,577	4.3
Multiplexers	1,210	1,260	1,375	1,425	1,460	1,550	5.1
T-1 multiplexers	700	725	790	950	1,100	1,250	12.3
Concentrators	250	250	260	250	225	235	-1.2
Other	550	620	710	785	840	910	10.6
Total	8,810	9,545	10,021	10,422	10,722	10,932	4.4

* Compound Annual Growth Rate
(p) Projection

Source: NATA Market Research Department

Facsimile Terminal Market

Introduction

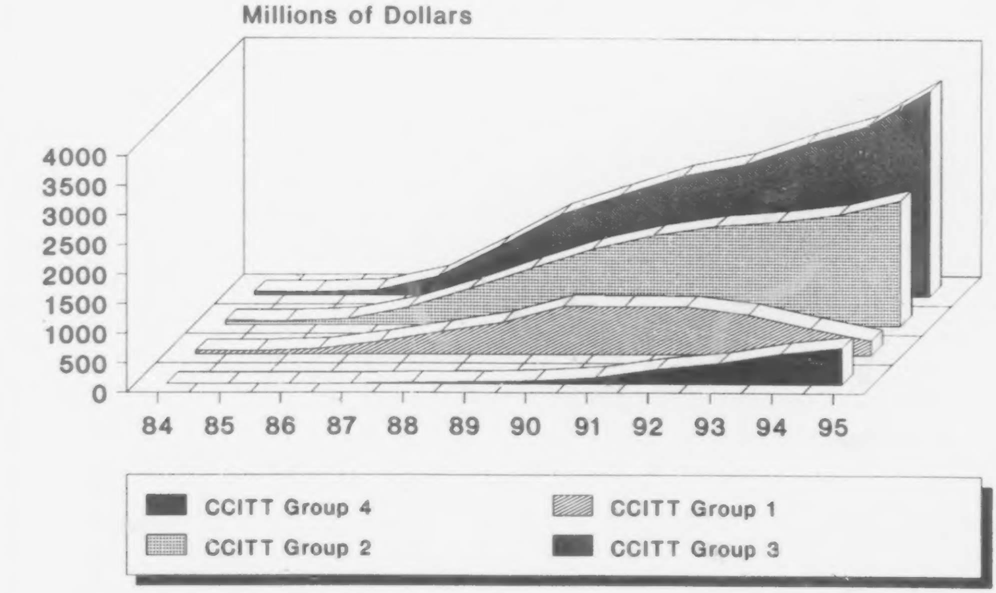
A facsimile terminal is a device that scans a document, encodes the information scanned, and transmits the information over a telecommunications circuit to be reproduced at the receiving end. The scanner sweeps across a page, segmenting it into multiple lines in a fashion analogous to the way an electron beam scans the faceplate of a television picture tube. The scanner produces an output that is either a continuous analog signal that varies between black and white, or a digital output that converts the image to a binary code. Control equipment directs the scanning rate and, in the case of digital facsimile, processes the signal to compress solid expanses of black or white. At the receiving end, the incoming signal is demodulated and drives a print mechanism that reproduces the received image on paper.

Facsimile transmission was invented in 1843. Despite this early introduction, facsimile transmission was not used extensively until the 1920s, when it began to be used for transmitting wire photographs and weather maps. It has only recently become a business tool. Early models were bulky and produced rather poor quality copy. Recent innovations have made the facsimile terminal practical for a mass market.

Since facsimile transmission involves the coding of information, the coding format must be standardized to achieve universal intercommunication. The most prevalent standards in use have been established by the International Telegraph and Telephone Consultive Commit-

Figure 54

Facsimile Terminal Market by Group, 1984-1995



Source: NATA Market Research Department

tee (CCITT), a committee within the International Telecommunications Union, part of the United Nations. The CCITT has established four standards for facsimile transmission: Group 1, Group 2, Group 3, and Group 4. Group 1 requires six minutes for transmission of a printed page, Group 2 requires two to three minutes; Group 3 requires one minute or less, and Group 4 requires only a few seconds.

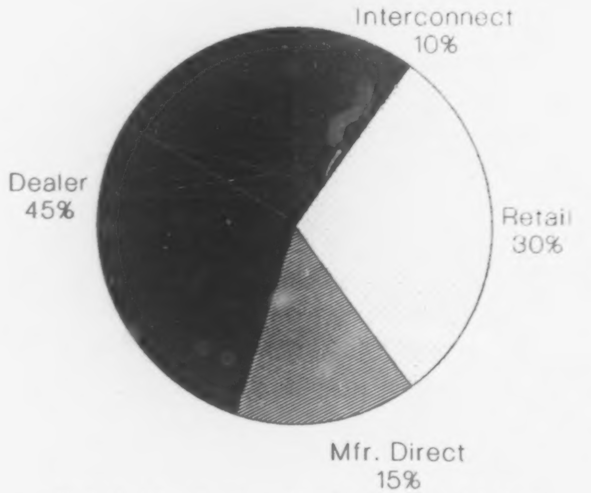
Market Review

The market for facsimile terminals has taken a number of years to reach the critical mass necessary for the market to take off. In terms of the value of the market, there was even a slight slump in 1985 when the market amounted to $164 million, down from $175 million in 1984 (Table 35, page 133). Since 1985, however, the market has experienced tremendous growth. In 1990, the market amounted to 2.8 million terminals valued at $3.9 billion. The market is expected to soar even more rapidly in the immediate future and reach 6.6 million terminals valued at $6.5 billion in 1995. The estimated number of fax transmissions has skyrocketed from 10 billion pages in 1987 to about 45 billion pages in 1990. The growth of the relative market shares of the different CCITT group types is shown in Fig. 54 on page 129.

Faxes are sold through several distribution channels. By far the most prevalent is through office-supply dealers, which accounted for 45 percent of the market in 1990 (Fig. 55). Other important channels include retail, with 30 percent, and manufacturer direct with 15 percent. Sales through CPE distributors account for the remaining 10 percent.

Figure 55

1990 Facsimile Terminal Distribution Channels



Total Market = 2.8 Million Units

Source: NATA Market Research Department

There are dozens of suppliers of fax terminals, each trying to capture market share. The most popularly sold brand of fax terminal in 1990 was Sharp, which captured 22 percent of the market (Fig. 56). Other important suppliers included Murata with 18 percent of the market, Canon with 11 percent, and Ricoh and Panasonic, each with 8 percent.

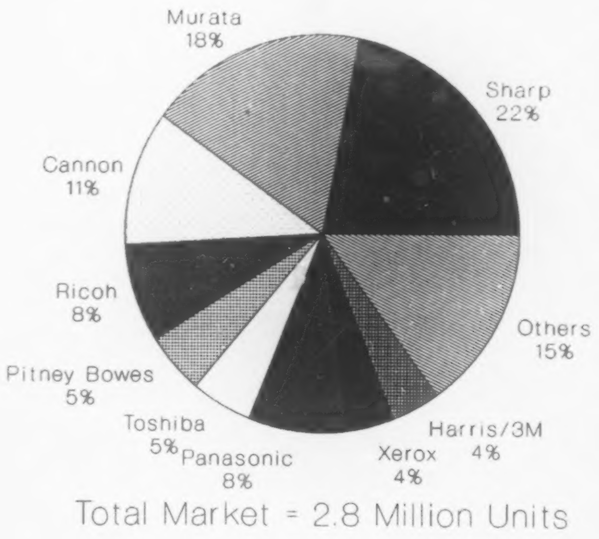
The growth in the installed base of fax terminals mirrors the growth in annual sales. The installed base increased steadily from 125 thousand units in 1984 to 4.4 million in 1990 and is expected to reach 15.2 million by 1995.

The industry sector that most commonly uses fax terminals is manufacturing. About 96 percent of all manufacturing facilities use fax transmission (Fig. 57 on page 132). The business services sector is next, with 95 percent of all banks using faxs. The lowest fax penetration is found in the government, with 83 percent of government facilities using facsimile terminals.

Along with traditional fax terminals, other innovative products such as fax boards, fax servers, and fax switches are gaining wide use. The use of fax boards in PCs is accelerating to improve the graphics quality and speed of faxed messages. Sales of PC/fax boards increased from 92,000 units in 1989 to 179,000 in 1990. Fax servers are also becoming attractive alternatives that likewise improve graphics quality and speed while allowing LAN users to share a fax gateway. In addition, small businesses trying to keep the number of telephone lines to a minimum are becoming interested in fax switches, which allow users to have one line for both voice and fax traffic.

Figure 56

1990 Facsimile Terminal Manufacturer Market Shares by Units Shipped



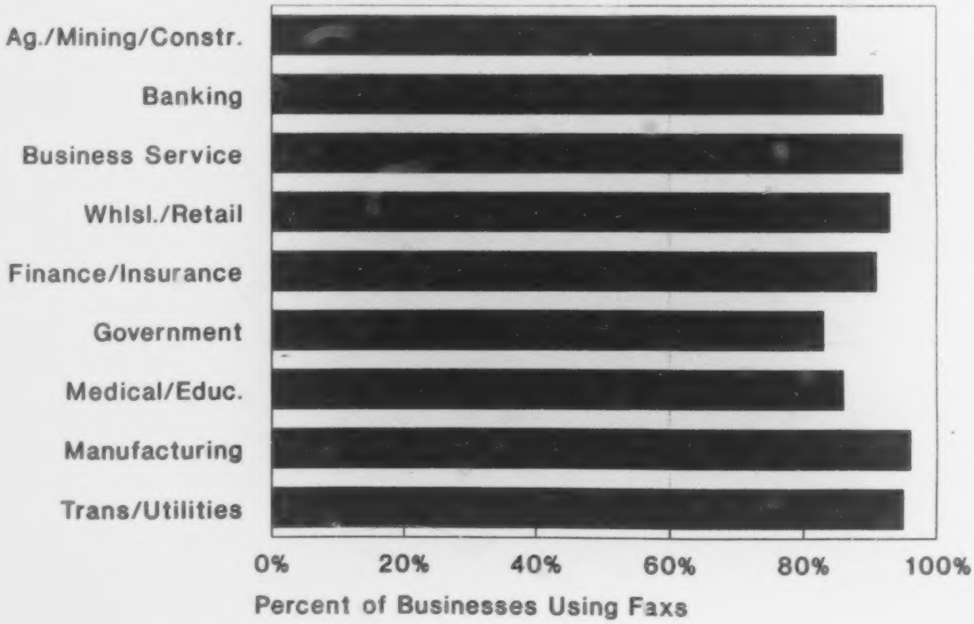
Total Market = 2.8 Million Units

Source: NATA Market Research Department

In addition to equipment sales, interexchange carriers entered the facsimile arena by offering high speed fax transmission services. These services offer users advanced features such as polling and broadcasting. The market for these fax services is estimated to be about $200 million annually.

Figure 57

1990 Facsimile Terminal Penetration by Industry



Source: NATA Market Pesearch Department

Table 35

Facsimile Terminal Market by Group, 1984-1995

	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*
Annual Sales:							
Quantity: thousands	35	36	75	350	1,050	1,925	122.9
Total Value: $ millions	175	36	260	821	1,825	2,877	75.1
CCITT Group 1: $ millions	58	54	86	215	376	538	56.1
CCITT Group 2: $ millions	63	60	96	295	610	959	72.4
CCITT Group 3: $ millions	54	50	78	311	823	1,365	90.8
CCITT Group 4: $ millions	0	0	0	0	15	25	N/A
Installed Base: 1000 Units	152	160	225	570	1,100	2,855	79.8

	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 Percent CAGR*
Annual Sales:							
Quantity: thousands	2,750	3,375	4,065	4,575	5,763	6,573	19.0
Total Value: $ millions	3,850	4,457	4,958	5,361	5,723	6,476	11.0
CCITT Group 1: $ millions	817	810	805	675	450	250	-21.1
CCITT Group 2: $ millions	1,283	1,515	1,675	1,755	1,875	3,120	19.4
CCITT Group 3: $ millions	1,700	2,027	2,228	2,571	2,876	3,481	15.4
CCITT Group 4: $ millions	50	105	250	350	522	625	65.7
Installed Base: 1000 Units	4,422	6,571	9,500	11,374	13,210	15,159	27.9

* Compound Annual Growth Rate
(p) Projection

Source: NATA Market Research Department

Call/Voice Processing Equipment Market

Introduction

The equipment discussed in this section answers, records, routes, distributes, makes, or otherwise manipulates telephone calls. The specific products addressed are voice messaging systems, voice response units, and automatic call distributors (ACDs). Probably the most popular of the three is the voice messaging system, a product that has been available in its present form since the early 1980s. Voice messaging, also called voice mail, is sometimes available as an optional feature on a PBX, but it is frequently a separate piece of equipment used as an adjunct to a business telecommunications system. A caller dials the called party's mailbox number and leaves a message. The called party can retrieve messages by dialing the mailbox from any touchtone telephone and entering a security code. By entering instructions using the key pad, the user can repeat, erase, forward, broadcast, or file the message.

Voice mail gives the called party more flexibility than an ordinary consumer answering machine. Voice messaging systems have become popular, especially with businesses, because they reduce the need for an operator, receptionist, or secretary to answer calls and take messages. Some studies estimate that 50 percent of all telephone calls are made simply to convey information and do not require a two-way conversation.

An automatic call distributor (ACD) is a device that concentrates incoming calls to a group of attendant service positions. An ACD is either a stand-alone system or included as a feature in a PBX. Typical applications are the service departments of large, high-telephone-traffic organizations such as airlines, utilities, catalog houses, and department stores. Incoming calls can be routed to an attendant position on the basis of incoming line type or other variables. When attendant positions are idle, the call is routed immediately. When the attendant positions are busy, calls are answered and placed in a queue, and the caller is notified by a recorded announcement that the call will be held until the next available operator is free.

Voice response systems incorporate some voice messaging-like features with other equipment, such as automatic attendants and data base management equipment, to provide automated call processing functions. Typically, these integrated voice response systems consist of hardware and software customized for an individual customer or type of customer.

Voice response systems can be interactive or noninteractive. An interactive system answers a call, gives the caller options from which to select, accepts responses entered by the caller using the telephone keypad, and allows the caller to access a data base and make some change to that data base. For example, a bank might have an interactive voice response system that would allow a customer to access his or her account, transfer funds, pay a credit card bill, etc. A noninteractive system simply gives the caller options, accepts the caller's choice of options, processes the caller's options by interacting with some external data base, and finally provides verbal information regarding the transaction. As an example, a centralized, city-wide events ticketing bureau might maintain a noninteractive voice response system whereby a caller would call and, through a menu, learn the time, date, and place of a particular event. The system would search through a data base, find the information, and, perhaps through synthesized speech, respond to the caller's inquiry.

Market Review

The market for call/voice processing equipment has increased from $112 million in 1984 to $2.2 billion in 1990 (Table 36, page 139). Most of this equipment is distributed and installed by the interconnect industry. These products have been among the key add-on peripherals interconnects have begun to sell to increase profit margins and customer satisfaction.

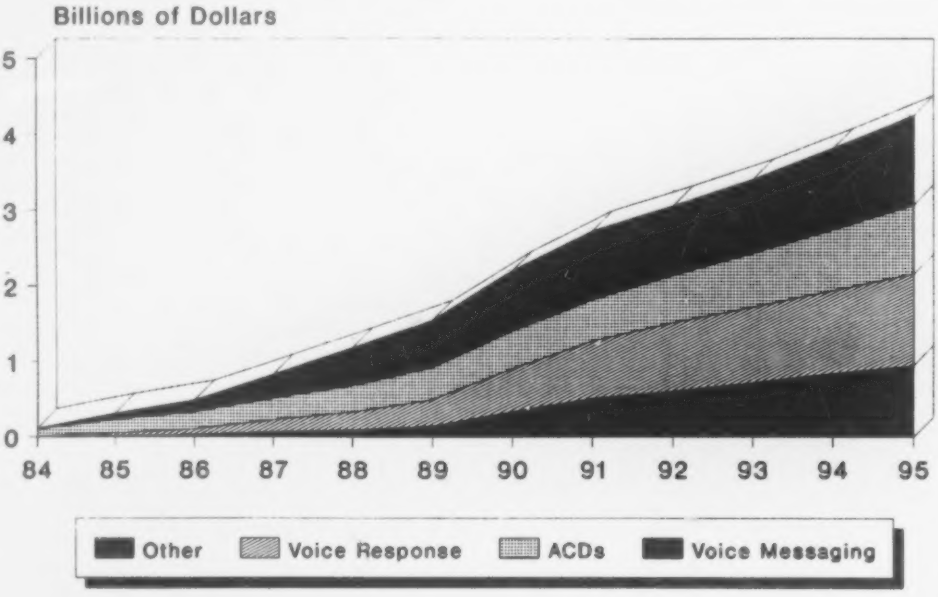
The principal product area is the voice messaging equipment market, which increased from $5 million in 1984 to $800 million in 1990 (Fig. 58). The market for this equipment is expected to grow to about $1.2 billion by 1995. In addition, the court overseeing the AT&T divestiture recently permitted the BOCs to offer voice messaging services. The FCC also relaxed its regulations, allowing the use of central office facilities used to provide local exchange service to also provide voice messaging. While many analysts believe this will stimulate the market, others are concerned that the initiative may lead to a shakeout of voice processing manufacturers due to the extensive resources available to the telephone companies and the possibility of anti-competitive telco activities.

The equipment market is spread widely over a number of suppliers. In terms of revenue, the largest market share in 1990 went to Octel, with 21 percent, followed by AT&T with 17 percent, and VMX with 10 percent (Fig. 59, page 136).

The market for voice response systems increased from $10 million in 1984 to $563 million in 1990. The market for these products will continue to increase rapidly as consumer

Figure 58

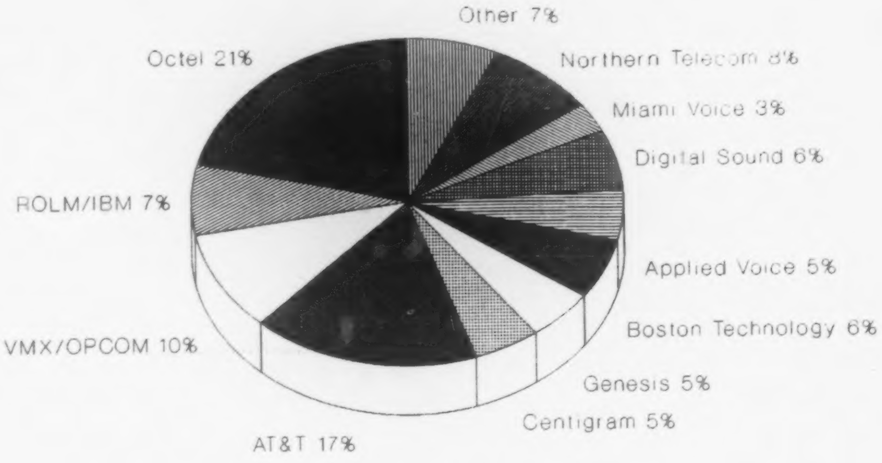
Call/Voice Processing Equipment Market by Type, 1984-1995



Source: NATA Market Research Department

Figure 59

1990 Voice Messaging Equipment Market by Vendor

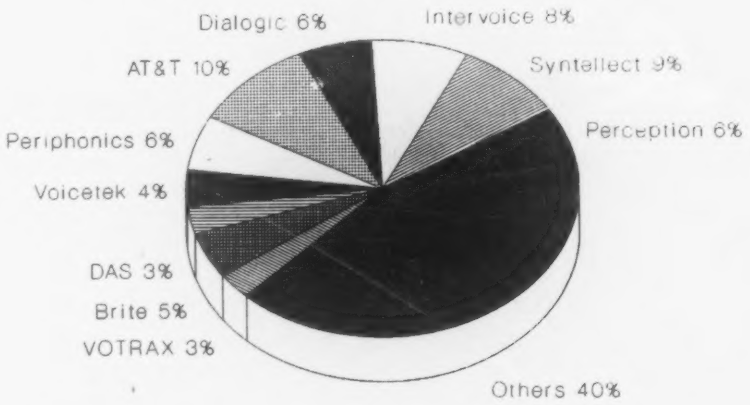


1990 Total Market = $800 Million

Source: NATA Market Research Department

Figure 60

1990 Voice Response Equipment Market by Vendor



1990 Total Market = $ 563 Million

Source: NATA Market Research Department and Vanguard Communications Corporation acceptance and new applications develop. By 1995, the market will surpass the value of the voice messaging equipment market and amount to $1.4 billion.

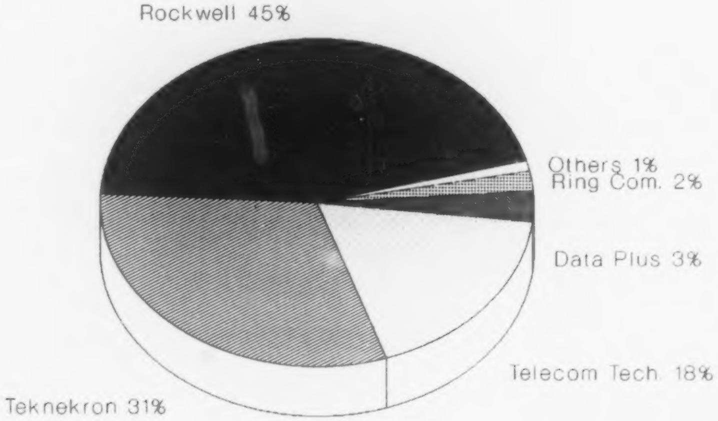
As with the voice messaging marketplace, the voice response equipment market has a number of suppliers, none of which dominate the market. The largest market share in 1990 went to AT&T with 10 percent, followed by Syntellect with 9 percent (Fig. 60, page 136).

Other types of equipment are more niche-type products. Even so, the market for ACDs has increased from $95 million in 1984 to $500 million in 1990 and is expected to amount to $915 million in 1995. The market for ACDs is dominated by several suppliers. In 1990 Rockwell had 45 percent of the market, Teknekron had 31 percent, and Telecom Technologies had 18 percent (Fig. 61).

Other types of products in this category include stand-alone automatic attendants (most automatic attendants are incorporated features in a PBX or voice/call processing unit), speech recognition devices, voice synthesizers, auto dialers, and similar equipment. The market for these products is expected to expand substantially through the next several years. Particularly noteworthy are speech recognition and voice synthesis. These technologies will develop rapidly and add a new dimension to voice/call processing. Once perfected and available in commercial quantities at moderate price levels, they will represent a significant impetus for the growth of all voice/call processing markets as they greatly expand the

Figure 61

1990 Stand-Alone ACD Market by Vendor



Total 1990 Market = $500 Million

Source: NATA Market Research Department

functionality and flexibility of the different systems.

In addition, a new dimension to voice processing is being realized through the integration of facsimile with voice processing. Companies are beginning to offer callers an option in their voice processing systems that electronically routes a document to the called party's fax machine. This new development, dubbed "fax on demand," will speed the delivery of product documentation and other routine printed matter. Other developments include the integration of voice mail with cellular and voice mail with electronic mail. These and other advances in voice processing technologies and applications will ensure a strong and dynamic market for years to come.

The expansion of the voice processing services businesses is one aspect of the marketplace impacting voice processing equipment sales. Voice processing services, principally voice messaging services, are offered by independent service bureaus that allow customers to subscribe to voice mail boxes for a certain fee per month. In addition to these independent service bureaus, the local telephone companies and long distance carriers are all offering, or planning to offer, voice messaging services to residential and business customers.

Some sources estimate that the number of subscribers of voice messaging services increased from 435,700 in 1988 to 1.1 million in 1990. From 1990, subscribership is projected to grow at a compound annual growth rate of 68 percent to 15 million by 1995. Revenue to the service bureaus is expected to experience similar growth. In 1990, revenues amounted to some $250 million, up 79 percent over the 1988 figure of $140 million. By 1995, revenue is expected to grow to $1.7 billion.

The impact on equipment sales will be mixed. Certainly there will be some displacement of equipment sales by service bureau subscribership, but in general, service bureaus tap the residential and small business market (although there are notable exceptions). This is not the market that would typically buy voice processing CPE. Furthermore, acclimating residential and small business users to voice processing technology should help stimulate the entire market.

Table 36

Voice/Call Processing Market, 1984-1995
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989	1984-89 CAGR*
							Percent
Voice Messaging Equipment	5	75	150	315	500	665	166.0
Voice Response Equipment	10	35	75	160	235	350	103.6
Automatic Call Distributors	95	183	228	285	350	425	35.0
Other**	2	15	30	70	100	150	137.1
Total	112	308	483	830	1,185	1,590	70.0

	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 CAGR*
							Percent
Voice Messaging Equipment	800	910	975	1,055	1,125	1,210	8.6
Voice Response Equipment	563	755	905	1,195	1,223	1,395	20.1
Automatic Call Distributors	500	550	630	715	805	915	12.8
Other**	350	520	610	725	845	950	22.1
Total	2,213	2,375	3,120	3,690	4,008	4,470	14.6

* Compound Annual Growth Rate

** Includes stand-alone auto attendants, speech recognition, voice synthesis, and similar equipment

(p) Projection

Source: NATA Market Research Department

Public Payphone Market

Introduction

The pay telephone was invented in 1889 by William Gray. Working part time for Gray, George Long, a 16-year old apprentice at Pratt & Whitney Co., built the first coin operated telephone which was installed in the Hartford Bank in Hartford, Connecticut. The pay telephone became very popular and attracted the attention of AT&T. In 1910, the Gray Telephone Pay Station Co. and AT&T joined forces to produce pay telephones. That arrangement lasted until 1934, when Gray sued AT&T for patent infringement and lost. AT&T soon became the only major commercial producer of pay telephones. This lasted until recently, when other domestic producers and foreign producers began vying for a piece of the growing payphone market.

The public pay telephone has been owned and operated by the local telephone company for virtually its entire one hundred year history. Competing companies, however, now have the opportunity to own and operate public payphones. Along with ownership comes all of the revenue potential of the device. Still, the marketplace for payphones is complex, and potential payphone operators must understand all aspects of the legal and marketing environment before attempting to exploit the emerging opportunities.

Much of the complexity of the competitive payphone environment comes from the hodgepodge of regulations varying widely by state. Moreover, many regulations on competitive payphone operators exacerbate a condition with which all of them must contend — an uneven playing field when competing against telco-owned payphone operations.

The competitive payphone industry began in June 1984, when the FCC opened the pay telephone equipment market to competition. The FCC ruled that parties other than telephone companies may register and interconnect their own pay telephones to the interstate telephone network under Part 68 of the Commission's rules and regulations.

While the 1984 FCC ruling opened the way for entrepreneurs to connect telephones to the interstate telephone network, the terms and conditions for the use of payphones for local and intrastate calling were left to the states. Because the states have exercised that mandate vigorously in some cases, a wide diversity exists in states' treatment of competitive payphones. Furthermore, despite the 1984 FCC ruling, competitive payphones are still illegal in Alabama, Arkansas, Connecticut, Hawaii, and Oklahoma. In those states, payphone competition has been precluded through the states' regulatory control over intrastate communications.

It becomes apparent from studying the pluses and the minuses of the competitive payphone industry that these companies provide a valuable service to consumers. To local exchange companies, revenue from payphone operations is a minimal portion of their overall income. The telcos traditionally have had little incentive to offer innovative payphone services or to explore all worthwhile locations for payphones. Competitive payphone operators, on the other hand, have brought about a revolution in public communication services, including credit card calling, public fax, store and forward voice messaging, voice synthesis, speed dialing, and data ports for lap-top computers.

In addition, because it usually is their only business, payphone operators are extremely concerned about downtime, vandalism, and customer satisfaction. Many are installing sophisticated networks that monitor when a payphone is in use or when the coinbox needs to be emptied and that perform self diagnostics to ensure proper maintenance and servicing.

A major problem for the industry is that most federal and state regulators do not fully understand the beneficial role competitive payphone operators play. The regulatory pendulum is not necessarily swinging in favor of the independent operators. Many of them may be forced out of business as one regulatory policy after another is implemented against them.

However, there are some patches of blue in the cloudy regulatory sky. One of the more progressive states in terms of payphone competition is California. In June 1990, the California Public Utilities Commission approved a compromise among the California Payphone Association, Pacific Bell, and GTE of California. The agreement calls for the local telephone company to reduce tariffs to competitive payphone operators by $2, reduce their charges for directory assistance, pay the competitive payphone operator 10 cents for each non-sent-paid intraLATA call routed to their networks, and provide maintenance termination unit testing on an optional basis. In addition, local carriers are to provide competitive operators with some of the services they provide for their own payphones, such as answer supervision, call scanning and rating, elimination of fraud-prone secondary dial tone, and a coin line or its equivalent.

Innovative state regulations such as California's may stimulate some activity at the federal level to put the competitive payphone industry on a more equal footing with telco-owned payphones. For example, a payphone petition filed by the Pay Telephone Council (PTC) and supported by NATA's American Public Communications Council (APCC) is pending at the FCC. The petition calls for the FCC to categorize payphones as customer premises equipment (CPE) similar to PBXs, which should be unbundled from transmission service. If adopted, the proposal would require local exchange carriers to make available to competitive operators payphone access lines with the same features currently associated only with telco payphones. Furthermore, the telco's local exchange service unit would be required to charge telco payphones and competitive payphones the same rates.

Other pending federal proposals would harm this infant industry, however. A petition filed by Bell Atlantic for billed-party preference would require payphones to deliver operator-assisted 0+ calls automatically to the long distance carrier presubscribed by the billed party, not to the carrier selected by the payphone company or location owner. This would eliminate contractual payments to long distance carriers for connection to those payphones. That creates no problem for telco payphones, since telcos would earn revenue for routing calls to the "preferred" interexchange carrier of the party paying for the call, and telcos receive substantial access fees from long distance carriers in any case. But, since competitive operators currently earn no fees unless they direct a call to be routed to a long distance carrier, implementation of this petition would remove a cornerstone of the competitive payphone industry.

On October 17, 1990, President Bush signed the Telephone Operator Consumer Services Improvement Act. As a result of strenuous advocacy by the APCC, the Act also required the FCC to address the issues of compensation for competitive payphone providers (CPPs) for calls where the CPP does not control the routing to the interexchange carrier. Typically, these are calls initiated by 800, 950, or 10XXX. On July 11, 1991, The FCC decided that competitive payphone providers are entitled to compensation, but left the amount and method of payment open to additional public comment. APCC has requested that the FCC issue a prompt and fair ruling regarding the compesation issue.

The FCC addressed the questions of 10XXX access through payphones by setting a deadline of six months for CPPs to convert their equipment to unblock 10XXX calls. Aggregators and owners of non-payphone equipment, such as hotels and hospitals, must unblock 10XXX calls within six months if their equipment is already capable of handling these calls. Equipment without this capability must be replaced within 18 months if the change can be done for less than $15 per line. All other aggregators have until April 17, 1997, to unblock access to 10XXX service.

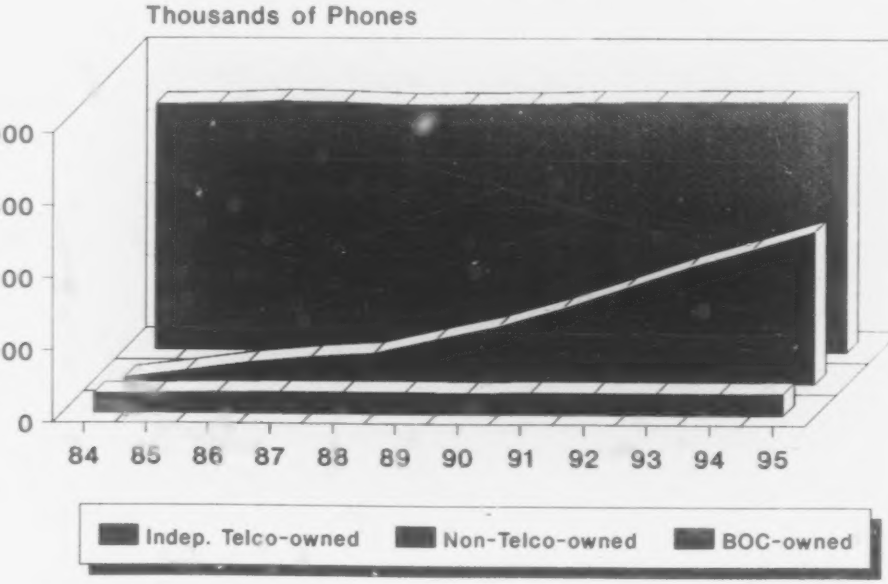
Market Review

The annual market for all payphones increased from 20 thousand units valued at $35 million in 1984 to 140 thousand units valued at $150 million in 1990 (Table 37, page 145, and Fig. 62). It is expected that sales of payphones will continue to grow rapidly and amount to 225 thousand units valued at $215 million by 1995. Moreover, while the average unit price is decreasing, the average level of sophistication of the payphone is increasing. The market for retrofitting kits (kits to add additional features to otherwise "dumb" phones) amounted to some $32 million in 1989 and is expected to almost double by 1995.

In terms of the installed base, telco-owned payphones amounted to about 1.8 million units in 1990, with the BOCs alone accounting for about 1.7 million units. This is expected to remain relatively stable over the next several years. Although precise data is not available, the consensus is that the installed base of nonLEC-owned pay telephones ranges from 200,000 to 250,000 units. By 1991, nonLEC-

Figure 62

Public Payphone Installed Base, 1984-1995



Source: NATA Market Research Department

owned payphones will account for some 20 percent of the installed base. Fig. 63 shows the relative shares of the installed base between telco-owned and nonLEC payphones for 1984-1995.

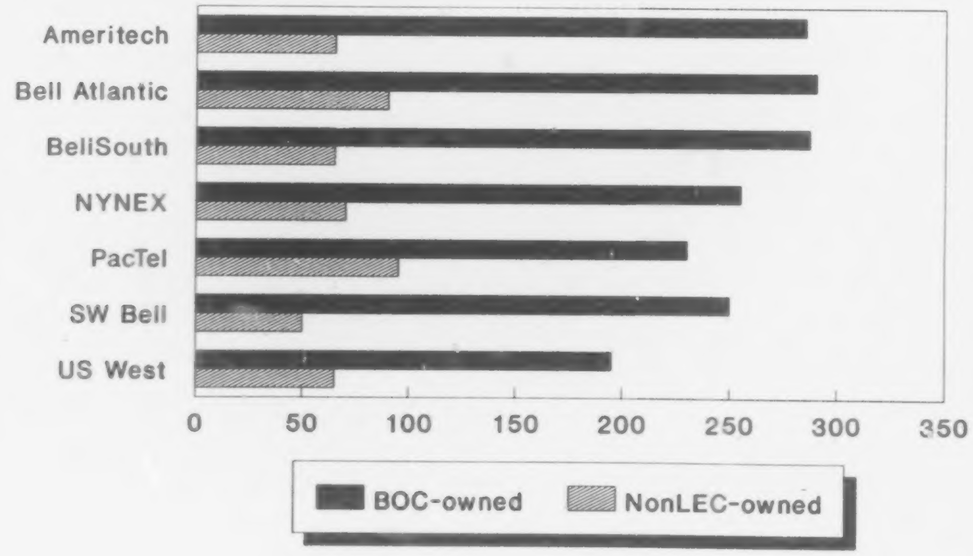
In comparing market penetration of nonLEC-owned payphones with that of BOC-owned payphones, the most significant inroads by competitive operators have been made in the Pacific Telesis territory, where the BOCs own 190,000 payphones and competitive companies own 60,000 payphones. However, data developed by Pacific Bell shows that more than 75 percent of the non-LEC payphones are new locations rather than replacement of existing LEC payphones. Competitive operators have been least successful in the Ameritech territory, where the BOCs own 285,000 payphones and competitive operators own 65,000 payphones. Much of the disparity between regions is accounted for by differing regulatory environments and the awarding of several major contracts.

RBOC revenue generated from public payphones increased from $1.5 billion in 1984 to $1.7 billion in 1990 (Fig. 64, page 144). Revenue is expected to increase slowly to $1.8 billion by 1995. As a share of the total, revenue from coin calls decreased during 1986-90, and is expected to continue to decrease through 1991. Non-coin revenue is almost exclusively attributed to toll calls.

Some estimate that the total revenue from payphones, including revenue to long distance carriers, approaches $7.0 billion per year. Of that, about $2.3 billion is spent on local and coin calls and the balance on long distance calls.

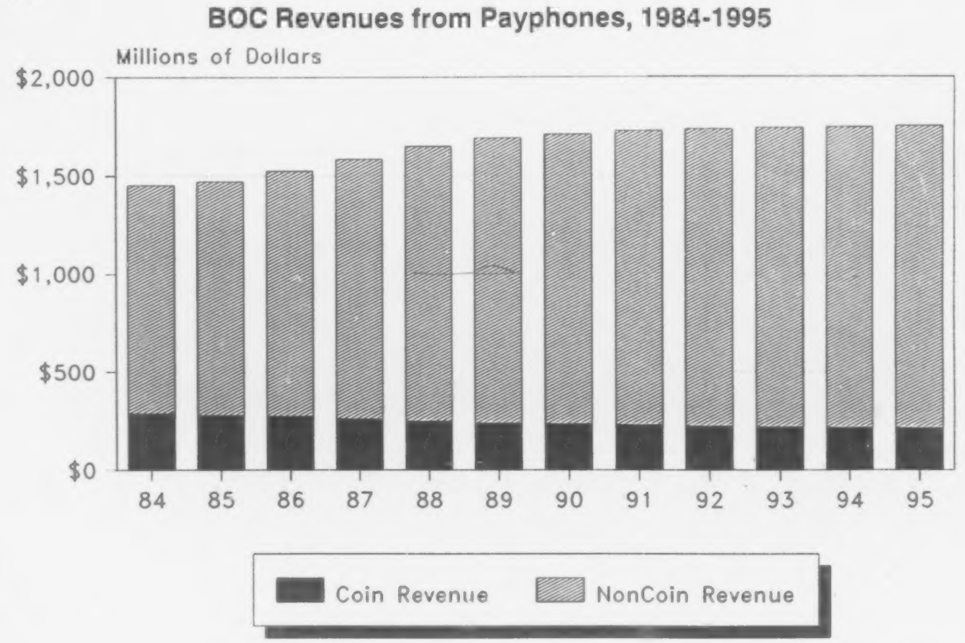
Figure 63

1990 BOC-Owned vs. NonLEC-Owned Payphones by Region



Source: NATA Market Research Department

Figure 64



Source: NATA Market Research Department

Table 37

Public Payphone Market, 1984-1995

	1984	1985	1986	1987	1988	1989(e)	1984-89 CAGR* (Percent)
Annual Sales:							
Quantity: thousands	20	23	27	45	90	140	47.6
Value: $ millions	35	37	40	60	100	150	33.8
Installed Base:							
BOC Owned: thousands	1,695	1,700	1,715	1,708	1,690	1,695	**
Independent telco: thousands	135	138	145	147	149	147	1.7
Non-telco-owned: thousands	25	75	135	175	200	295	64.0
BOC Public Payphone Revenue:							
From Coin Calls: $ millions	290	279	275	260	250	240	- 3.7
Other: $ millions	1,162	1,191	1,250	1,325	1,400	1,450	4.5
Other Payphone Related Revenue: $ millions***	1,100	1,450	1,900	2,275	2,375	2,400	17.0

	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 CAGR* (Percent)
Annual Sales:							
Quantity: thousands	210	205	210	215	220	230	1.8
Value: $ millions	222	210	215	215	217	225	0.3
Installed Base:							
BOC Owned: thousands	1,700	1,710	1,713	1,715	1,718	1,720	0.2
Independent telco: thousands	148	149	147	147	149	152	0.5
Non-telco-owned: thousands	500	525	650	795	920	1,050	16.0
BOC Public Payphone Revenue:							
From Coin Calls: $ millions	235	230	225	220	217	215	- 1.8
Other: $ millions	1,475	1,495	1,510	1,520	1,527	1,535	0.8
Other Payphone Related Revenue: $ millions***	2,550	2,750	2,975	3,090	3,175	3,260	5.0

* Compound Annual Growth Rate

** Less than .05 percent

*** Principally revenue to long-distance carriers and operator service providers

(p) Projection

Source: NATA Market Research Department

Videoconferencing Market

Introduction

Videoconferencing is a communications system that allows users to transmit video images and accompanying audio between two or more locations. The transmission is typically two-way (each user has the capability to transmit and receive) and real-time (the image appears without delay from the time of the actual event). The quality of the video ranges from that of full motion commercial TV to freeze-frame images transmitted every few seconds, depending on the type of equipment available. Audio quality ranges from that of a commercial telephone call (3 kHz) to high fidelity sound (7 kHz).

To transmit a relatively high quantity of signal data in a short time period requires state-of-the-art transmission equipment and technologies. Videoconferencing has not been able to provide cost-effective communications using analog signals similar to cable TV systems and other commercial networks. The development of compressed digital video transmission reduces the wide bandwidth and large amount of information necessary for an analog signal. This advancement provides increased quality and decreased cost for videoconferencing users.

The transition from analog to digital was accomplished through the development of video codecs. A codec (coder-decoder) converts analog transmissions into digital signals compatible with modern digital transmission systems. At each end, a codec performs the analog to digital encoding and digital to analog decoding. Improved digital compression equipment developed in 1989 allows for data rates as low as 56 kbps. This contrasts sharply with the 90 mbps required by the original Picturephone®, introduced by AT&T in 1964. Greater transmission rates lower the transmission costs to the user.

Equipment limitations on various systems dictate the number of locations from which the transmissions originate, such as branch offices in different cities.

Still image model, the basic video product, sends a single freeze-frame image at a time. This can be relatively inexpensive and particularly useful if only still images, for example charts or diagrams, need to be transmitted.

Image quality, measured in number of picture elements (pixels), varies significantly, as does transmission time, which ranges from a few seconds up to several minutes per image.

Transportable systems have been developed which can literally be rolled into any conference room, thereby creating an instant videoconferencing facility.

Real-time, two-way videoconferencing has been available to the public through common carriers for well over a decade. Companies without in-house videoconferencing capabilities have been able to move their meeting to a local transmission facility at a location outside their office to rent time on local, national, and international networks. Videoconferencing services charge fees for room rental, network access, and long-haul transmission. Firms benefit by avoiding the incurred cost of installing videoconference rooms at every branch office. Instead, public facilities are rented when necessary. In addition, use of public facilities permits users without videoconference facilities to conduct meetings with videoconference-capable firms. When deciding whether to install private, in-house facilities or to rent public services, users need to determine whether 24-hour access without appointment, as with private rooms, and customized meeting room facilities are worth the greater expense than that incurred by utilizing standard common carrier services. Consultants who provide expertise on room design and engineering often provide information helpful in installing in-house videoconferencing facilities and networks.

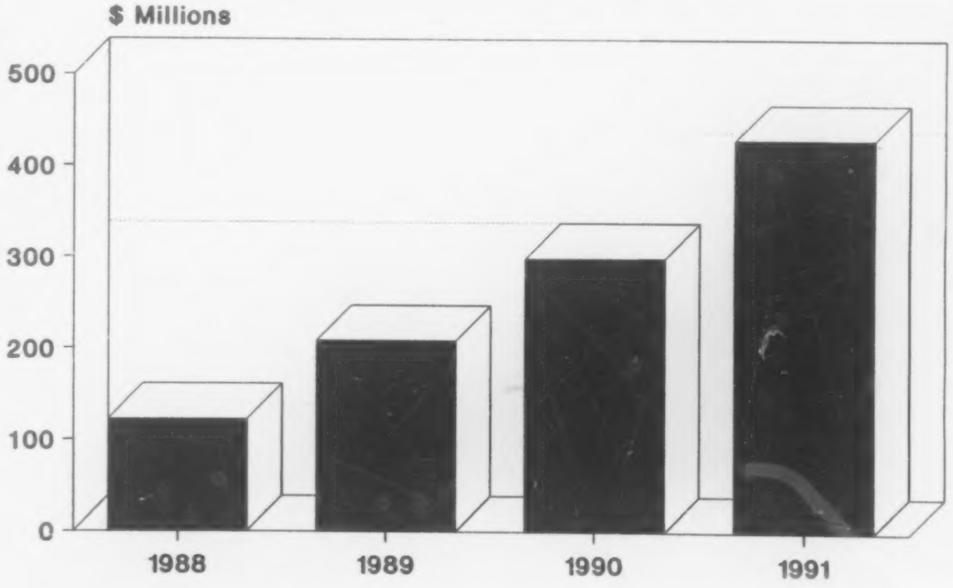
Market Update

With the addition of off-the-shelf software and hardware, many PCs, including IBM, AT&T, and MS-DOS compatible systems, can input videoconferencing images for storage and display. During 1991, the number of PC-based image capture devices is expected to increase substantially. Within one to two years, nearly all PCs on the market will have the capability to input, store, and transmit video images. Some systems cost less than $500. Image scanning, creating, and editing software characteristics, high resolution graphics, and mouse compatibility are some PC features already available that can be applied to videoconferencing. Many models are expected to possess real-time PC interaction between user stations. PC users should anticipate updating their systems with these types of image manipulation and transmission capabilities over the next few years, especially firms which plan to purchase PCs this year. The ability to add these features becomes more important as videoconferencing, particularly versions employing PCs, becomes universal among larger firms in certain industries.

The adoption of international videoconferencing standards by the CCITT in late 1990 should end the use of proprietary algorithms. The new algorithm, called H.261, specifies a channel rate multiple of Px64 (pronounced "P times 64"). Its implementation will require some users to replace their older, incompatible

Figure 65

Two-Way Videoconferencing Market, 1988-1991



Source: International Teleconferencing Association systems. All video codecs compatible with Px64 will use the same channel rate multiple of 64 kbps to encode and decode signals. Overall, the development of standards is likely to ease the fear of not being able to videoconference with some clients and customers due to system incompatibility. In the past, this concern has prevented firms from purchasing a system. On the manufacturing side, industry acceptance of standards will entice many domestic and international firms to enter the market, thereby lowering unit prices to consumers.

Domestic use of two-way videoconferencing equipment increased substantially from $208.8 million in 1989 to $299.4 million in 1990 (Table 38, page 149, Fig. 65, page 147). The industry is expected to further expand to $429.3 million in 1991.

Within the two-way sector, use of transport-capable equipment increased 54.0%, room and non-codec equipment 38.3%, and codecs 32.3% from 1989 to 1990. Videoconferencing, in general, is expected to continue its growth trend as equipment becomes more affordable and as firms recognize that their equipment is nearly universally compatible due to H.261 standards.

Table 38

Teleconferencing Market, 1988-1991

Annual Growth	1988	1989	1990	1991 Forecast
Audio				
Room Terminals	59.9%	37.9%	36.3%	
Bridges	19.9%	-4.0%	46.4%	
Transport & Services	22.7%	16.0%	25.0%	
Total	$328.9	$380.2	$503.9	$639.6
Audiographic/Video Minus				
Telewriters	54.3%	16.7%	-14.3%	
Captured Frame Video	57.8%	-7.0%	9.2%	
Transport	23.2%	17.1%	15.0%	
Total	$54.6	$61.4	$68.0	$75.2
Video				
Two-Way**				
Codecs & MCUs	40.1%	76.7%	32.3%	
Room & Non-codec Equip.	22.6%	57.0%	38.3%	
Transport	53.0%	72.6%	54.0%	
Total (Two-Way)	$122.4	$208.8	$299.4	$429.3
One-Way				
Ad hoc services	4.8%	9.1%	-25.0%	
Ad hoc transport	13.6%	10.0%	-27.3%	
Business television svcs	21.5%	13.1%	-6.9%	
Business television trans	71.6%	12.3%	7.7%	
Total (One-Way)	$151.4	$169.9	$157.6	$157.5
TOTAL	$657.3	$820.3	$1,028.9	$1,301.7

* Growth rates are shown as year-to-year percentages. Totals and 1991 forecast shown in millions of dollars. Forecast for 1991 is based on the annual rate of growth shown from 1998-1990.

Source: International Teleconferencing Association

Residential Telecommunications Market

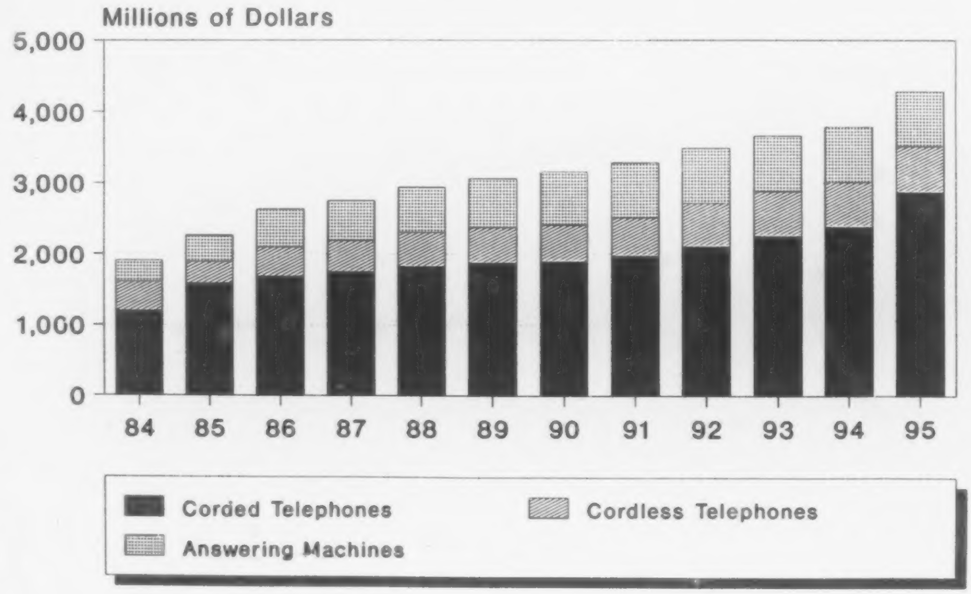
Introduction

The residential telecommunications market dates back over a hundred years to the invention of the telephone. Over the years, the telephone and the telephone system evolved to provide users with better service and more features. The telephone itself has evolved from an electromechanical to an electronic device. The switch to electronics began in the 1960s and 1970s as the transistor gave way to its successor, the integrated circuit. With the conversion to electronics, advanced features became available. In the late 1970s, the cordless telephone and the consumer telephone answering machine were developed. On the horizon for consumer telecommunications is the ISDN, which will provide consumers with the ability to achieve voice, data, and video communication through a video telephone terminal. Common services most likely to be available will be catalog browsing and purchasing, electronic mail, electronic banking, etc. This study however, addresses only the U.S. market for corded telephones, cordless telephones, and telephone answering machines.

Over 90 percent of households in the United States have telephone service, representing a large market for telephone instruments. Since the late 1960s, consumers have been legally able to buy and install telephone equipment. However, the market did not take off until the 1980s. During 1982-84, inexpensive, one-piece telephones became very popular, and millions of them were sold. Their popularity died out, however, due to lack of

Figure 66

Residential Telecommunications Equipment Market, 1984-1995



Source: NATA Market Research Department

good sound quality and reliability. Currently, the market for consumer phones is driven by features such as hold, speed dialing, mute, liquid crystal displays, etc. Another factor impacting the market is the developing movement toward home offices and telecommuting. This will push the market toward more sophisticated products for residential use.

Market Review

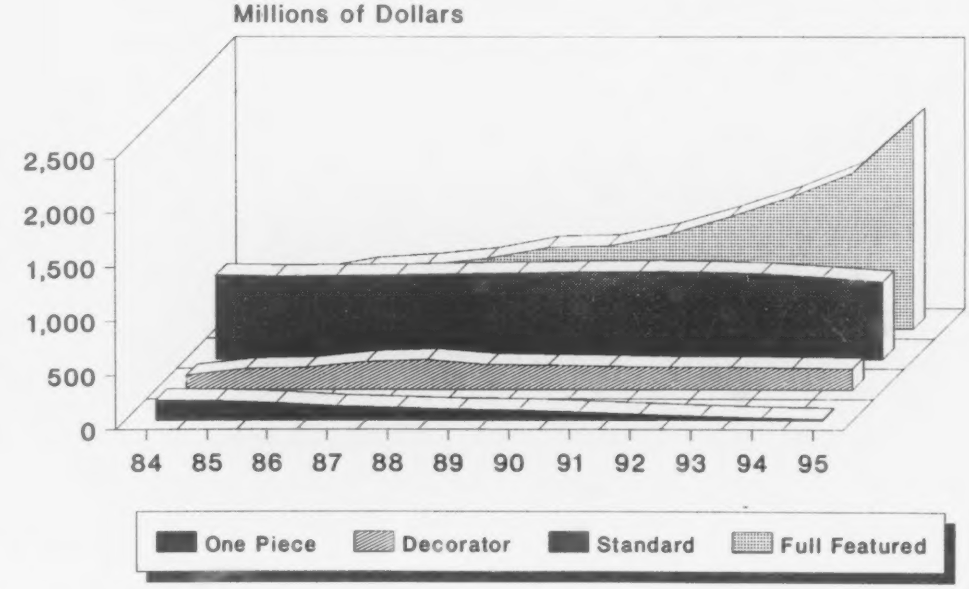
The market for all types of corded telephones increased from $1.2 billion in 1984 to $1.9 billion in 1990 (Table 39, page 153, and Fig. 65, page 149). It is expected to increase to $2.9 billion by 1995. The market for full-feature phones has been the fastest growing segment, increasing from $110 million in 1984 to $765 million in 1990, and expected to exceed $1.9 billion by 1995. The changes in relative market shares of the different types of phones are presented in Fig. 67.

The market for cordless telephones also went through a period of extreme popularity in the early 1980s, but began to wane as problems with unauthorized use (or monitoring), sound quality, and reliability became apparent. New models, using different frequencies and having increased protection from unauthorized use, became available in the mid-1980s. The market for cordless telephones decreased from $410 million in 1984 to $305 million in 1985 before increasing to $498 million in 1987 and to $695 million by 1990.

The market for telephone answering machines has increased from $298 million in 1984 to $750 million in 1990. An initial resistance to answering machines has been overcome as our society becomes dominated by

Figure 67

Corded Telephone Instrument Market by Type, 1984-1995



Source: NATA Market Research Department

households with large segments of time during the day when no one is home. In addition, with increasing business use of voice messaging systems, consumers are becoming more comfortable with answering machines. Also, the BOCs were recently granted the ability to offer voice messaging services. Undoubtedly, before long there will be BOC advertising campaigns underway across the country which will familiarize people with the benefits of talking to a machine. By 1995, the market is expected to reach $765 million.

Table 39 Residential Telecommunications Market, 1984-1995

	1984	1985	1986	1987	1988	1989	CAGR*
Corded Telephone Instruments:							
Standard:							
Value: $ millions	775	765	770	775	788	795	0.5
Quantity: million units	26	27	29	31	34	34	5.5
One Piece:							
Value: $ millions	185	180	162	129	115	100	-11.6
Quantity: million units	12	12	11	10	10	9	-5.6
Decorator:							
Value: $ millions	130	190	207	257	275	230	12.1
Quantity: million units	2	3	3	4	5	5	20.1
Full-featured:							
Value: $ millions	110	450	551	589	647	750	46.8
Quantity: million units	1	2	3	4	5	6	43.1
Total:							
Value: $ millions	1,200	1,585	1,690	1,750	1,825	1,875	9.3
Quantity: million units	41	44	46	49	54	54	5.7
Cordless Telephones:							
Value: $ millions	410	305	410	438	474	498	4.0
Quantity: million units	4	3	4	4	5	5	4.6
Telephone Answering Machines:							
Value: $ millions	298	371	535	557	634	680	17.9
Quantity: million units	4	5	7	7	9	9	17.6

	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	CAGR*
Corded Telephone Instruments:							
Standard:							
Value: $ millions	805	810	805	790	755	715	-2.3
Quantity: million units	35	35	36	36	35	34	-0.6
One Piece:							
Value: $ millions	95	75	55	35	20	10	-36.3
Quantity: million units	9	8	6	4	3	2	-26.0
Decorator:							
Value: $ millions	225	215	205	205	200	195	-2.8
Quantity: million units	5	5	4	4	4	4	-4.4
Full-featured:							
Value: $ millions	765	875	1,035	1,220	1,440	1,943	20.5
Quantity: million units	6	7	9	10	12	15	20.1
Total:							
Value: $ millions	1,890	1,975	2,100	2,250	2,415	2,863	8.7
Quantity: million units	55	55	55	54	54	55	**
Cordless Telephones:							
Value: $ millions	695	710	707	800	980	950	6.5
Quantity: million units	8	9	9	10	11	11	6.6
Telephone Answering Machines:							
Value: $ millions	750	770	790	780	775	765	0.4
Quantity: million units	10	11	11	12	12	13	5.4

* Compound Annual Growth Rate
** Less than .05 percent
(p) Projection

Source: NATA Market Research Department

MOBILE COMMUNICATIONS MARKET

MOBILE COMMUNICATIONS MARKET

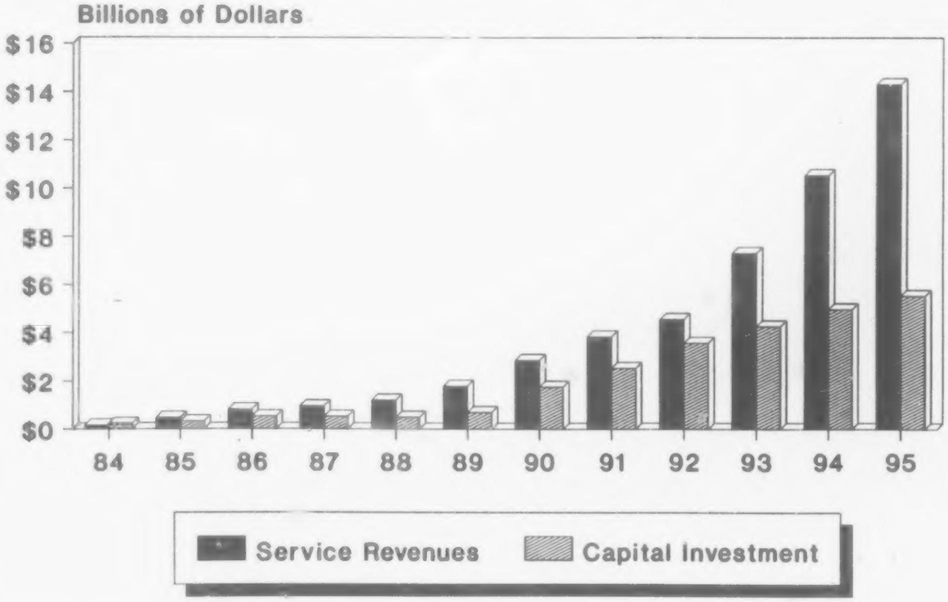
Introduction

In this report, mobile communications refers to networks that allow individual users to communicate with other users when at least one person is using a device connected to the network through radio transmission. In other words, techniques such as satellite communications links and infrared communications are not discussed. The two most popular forms of mobile communications, and the two addressed in this report, are cellular radiotelephony, and radio paging, *i.e.*, mobile telephony.

New forms of mobile communications are being developed. One of the more promising is known as personal communications networks (PCN). PCN subscribers would have a low-powered, pocket-sized phone that would be operational within only a short distance (essentially, within sight) of a transmitter. At least initially, the subscriber would be able only to place calls, not receive them. The uses for this type of phone would be similar to the uses of a payphone, in that an individual placing a call would generally have to be stationary. This technology has been advanced significantly in the United Kingdom, but is only in a developmental stage in the United States.

Figure 68

Cellular Service Revenues and Annual Capital Investment, 1984-1995



Source: U.S. Department of Commerce

Cellular Radiotelephony

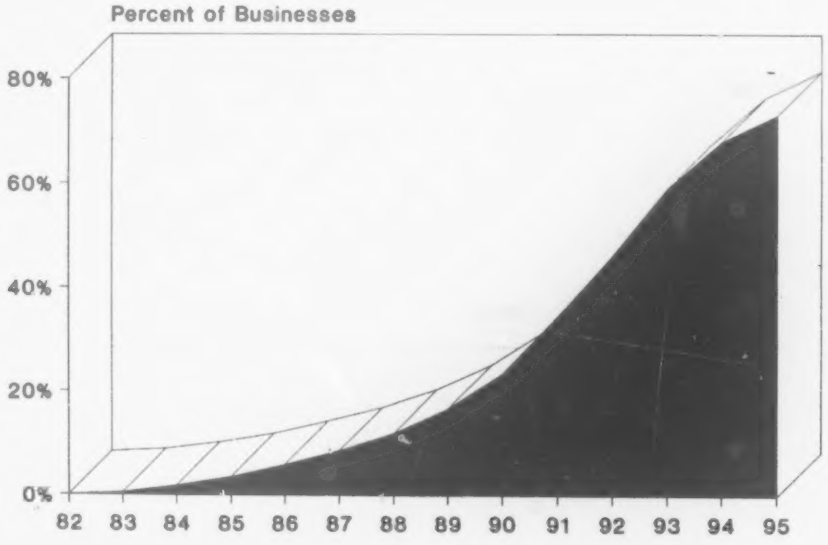
Cellular telecommunications systems represent the newest generation of radiotelephone systems. Radiotelephones have been available for many years, but have been limited in market penetration due to the scarcity of available radio spectrum. Cellular telecommunications solves that problem by dividing a geographic area into cells and reusing frequencies in nonadjacent cells. Each cell has a low power transmitter which can transmit within only a limited area. When a person with a cellular phone travels from one cell to another, the call is "handed off" to the transmitter of the second cell. These two aspects, frequency reuse and handing off, allow for a great many more subscribers per system than traditional mobile telephone systems.

While cellular technology has been available for a number of years, commercial implementation of the technology had to receive approval by the Federal Communications Commission (FCC). Cellular service on a commercial scale was introduced in 1984. The FCC mandated that there be two systems operators per market area, one of which was to be a cellular subsidiary of the local telephone company. Awarding licenses for the other systems became chaotic as the revenue potential became apparent, and the FCC was flooded with applications. At the end of 1990, there were 575 systems on-line.

In general, the cellular industry consists of three segments: manufacturers of cellular telephones; manufacturers of cellular systems (and system components); and operators of cellular systems. In addition, other segments have developed that feed off one or more of the three main sectors. One example is the cellular telephone agent. This type of company markets to potential cellular subscribers and

Figure 69

U.S. Cellular Penetration 1982-1995



Source: NATA Market Research Department

receives a commission from the system operator for every subscriber who signs up.

One dramatic development in 1990 was Motorola's announcement of plans for a new cellular network called Iridium. As envisioned by Motorola, this new cellular network, which will complement the existing terrestrial network, would span the globe with 77 low-altitude satellites stationed in orbit around the earth to relay signals between callers. Motorola estimates the capacity of the system will be 10 million users. It will be especially useful in rural areas, where terrestrial cellular is not economical. Motorola is seeking partners around the world, but has already announced a date in 1992 for the initial deployment of demonstration satellites, with full implementation slated for 1994 and full service capabilities by 1996.

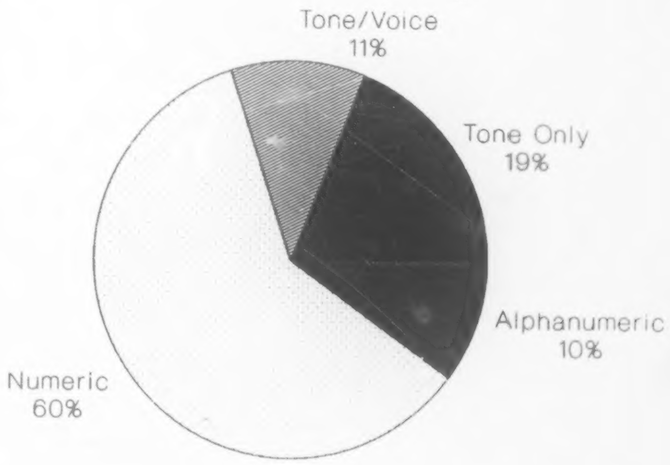
Cellular Market Review

The number of cellular subscribers in the United States has increased from 91.6 thousand in 1984 to over 4 million in 1990 and is expected to soar to 18.1 million by 1995 (Table 40, page 163). Cellular telephones, originally marketed principally to business people, are becoming a consumer product. The price of the phones themselves has decreased from $2,000-$4,000 per phone three or four years ago to $100-$300 today for a basic phone. Recent inroads made by producers in Hong Kong, Singapore, and South Korea indicate that the price of the phones is likely to fall farther.

There are three different types of cellular telephones: mobile, used primarily in an automobile; transportable, used either in an automobile or converted and carried in a

Figure 70

1990 Pagers in Use by Type



Total Pagers In Use = 11.2 Million

Source: NATA Market Research Department

pouch; and hand-held portable, "pocket-sized," to be used portably. According to industry estimates, the percentage of the market accounted for by mobile units will decrease from 69 percent in in 1989 to 54 percent in 1995, while the proportion of hand-held portable units will increase from 19 percent to 40 percent during the same time period. The balance is accounted for by transportable units.

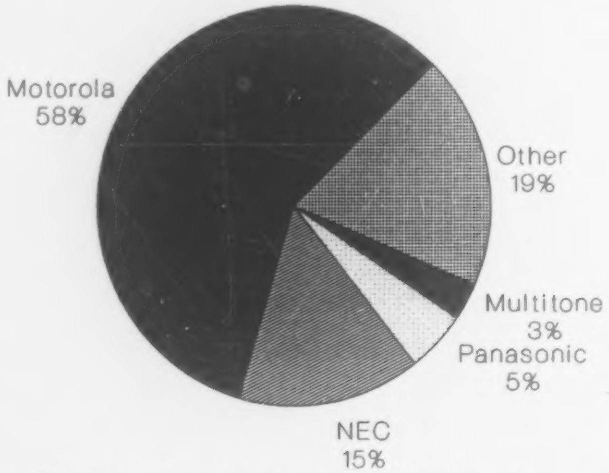
There are some 15 suppliers of cellular phones to the U.S. market. The largest U.S.-based supplier is Motorola. Significant foreign-based suppliers include Toshiba, NEC, Panasonic, Uniden, Mitsubishi, and Oki. According to some industry sources, Motorola has the lion's share of the hand-held portable markets, with 35 percent. In the market for mobile units, no one producer has more than 15 percent of the market. In the transportable market, Motorola comes in a distant fifth with 10 percent, behind Panasonic (20 percent), Mitsubishi (15 percent), Uniden (13 percent), and Novatel (12 percent).

The two principal suppliers of cellular systems in the U.S. marketplace are Motorola and AT&T. With roughly equally portions, Motorola and AT&T together account for over 80 percent of the systems installed. In general, AT&T has been more successful with the BOCs' cellular subsidiaries, while Motorola has been very successful with the nonLEC (nonwireline common carrier) market.

Annual capital investment costs of the cellular systems operators have increased from $234 million in 1984 to $1.0 billion in 1990 (Fig. 68, page 157). Service revenues have increased from $178 million in 1984 to $3.0 billion in 1990. The anticipated growth in

Figure 71

1990 Pager Installed Base by Manufacturer Market Share



Total Pagers In Use = 11.2 Million

Source: NATA Market Research Department

revenue has spurred tremendous activity among franchise operators. Mergers and aquisitions have become commonplace. BOC cellular subsidiaries are crossing over into other BOC regions to become the competing carrier. BellSouth has been particularly aggressive in acquiring competing cellular franchises. GTE increased its cellular base substantially through the acquisition of Contel. The largest cellular carriers as of mid 1989 were McCaw with 687,000 subscribers, Southwestern Bell with 667,000, GTE with 650,000, PacTel with 509,000, and BellSouth with 447,000.

Aside from the price of the phones themselves, the other impediment to developing a mass market is the monthly price of the service. That too is dropping, although not quite as rapidly as the price of the phones. The service is still generally more costly than regular telephone service, but as the number of subscribers increases, thereby reducing the marginal cost per subscriber, the cost of service will decrease.

In 1990, the cellular telecommunications network began to convert to digital technology. While the current analog systems have tremendous capacity compared to that available before, there are practical limitations on the number of subscribers per system. For a given amount of radio spectrum, digital technology will allow the systems to have significantly more subscribers than analog systems. In addition, there are other technical reasons that make digital technology superior to analog. Once the digital systems are in place, the marginal cost per subscriber is likely to decrease dramatically. At that point, it is projected that cellular will become a relatively inexpensive consumer product/service and, according to industry sources, may reach penetration levels of 50 percent of businesses (Fig. 69, page 158). Industry sources estimate that by 1995, 80 percent of cellular phones will be digital, 10 percent will be dual mode, and 10 percent will be analog. Moreover, by that time, business usage will account for some 55 percent of total cellular usage, and personal usage will account for 45 percent.

Currently the most prevalent users of cellular are professionals with 13 percent of total usage; next are sales personnel with 12 percent, followed by managerial personnel with 11 percent and housewives with 9 percent. The balance is accounted for by other types of users. In terms of businesses that use cellular, the largest category is business services with 35 percent, followed by retail with 14 percent, construction with 12 percent, and manufacturing with 8 percent. The balance is accounted for by a variety of other businesses.

Radio Paging Networks

In general, paging systems fall into two categories: low capacity, typically private systems used in environments such as hospitals and campuses; and high-capacity radio paging systems typically administered by the local telephone company or a radio common carrier. The types of messages that can be sent over the different systems include voice messages (available only in a low-capacity system), tones (or beeps), visual displays, or any combination thereof. Low capacity systems, which usually cannot have a subscriber base of more than about two hundred, frequently transmit tone and voice messages. High-capacity systems usually are able to have a subscriber base of several thousand.

While pagers are used throughout the economy, several sectors find such services to be particularly useful. Approximately one-third of all pagers are used in service indust[illegible] The construction, transportation, [illegible]s, and communications sectors are also large users, each accounting for about 15 percent of pagers in operation.

Radio Paging Market Review

The annual market for radio pagers has increased steadily over the past several years from some 1 million pagers valued at $250 million in 1984 to over 3 million pagers valued at $490 million in 1990. Annual sales are expected to amount to 8.2 million units valued at $790 million by 1995.

About 60 percent of the pagers in use are capable of numeric messages; about 19 percent are capable of tone only; 11 percent combine tone and voice; and the balance are capable of full alphanumeric messages (Fig. 69, page 159). The market has become very competitive, with a number of suppliers jockeying for market share. The undisputed leader is Motorola, with 58 percent of the installed base (Fig. 71, page 160). NEC is a distant second with 15 percent. Panasonic has about 5 percent and Multitone, through its Radio Shack sales, has garnered 3 percent of the market.

The market for radio pagers is likely to continue to be dynamic over the next several years, with the total number of subscribers expected to reach 28 million by 1995, up from 9.4 million in 1989. New growth will come as a result of innovative product design, as in the new wristwatch pager, and alternate channels of distribution, as in case of Multitone's success at selling through Radio Shack stores.

Table 40

Mobile Communications Market, 1984-1995

	1984	1985	1986	1987	1988	1989	1984-89 Percent CAGR*
Radio Pagers:							
Annual Sales Value: $ millions	250	299	352	399	430	490	14.4
Annual Sales Volume: $ millions	1.0	1.3	1.6	1.9	2.3	2.8	22.9
Pagers In Use: millions	3.8	4.5	5.4	6.5	7.8	9.4	19.9
Cellular:							
Telephones:							
Annual Sales Value: $ millions	187	575	785	875	1,013	1,456	50.8
Annual Sales Volume: thousands	75	280	393	475	675	1,120	72.0
Subscribers: thousands	92	340	682	1,100	1,775	2,577	94.7
Network Equipment:							
Annual Sales: $ millions	234	322	526	526	500	700	24.5
Systems on Line: Number	33	105	171	312	450	510	73.0
Service Rev.: $ millions	178	482	823	960	1,204	1,800	59.0

	1990	1991(p)	1992(p)	1993(p)	1994(p)	1995(p)	1990-95 Percent CAGR*
Radio Pagers:							
Annual Sales Value: $ millions	490	500	550	695	700	790	10.0
Annual Sales Volume: $ millions	3.2	4.0	4.7	5.6	6.8	8.2	21.0
Pagers In Use: millions	11.2	13.5	16.2	19.4	23.3	28.0	20.1
Cellular:							
Telephones:							
Annual Sales Value: $ millions	1,773	1,877	1,905	2,034	2,371	2,452	6.7
Annual Sales Volume: thousands	1,760	2,175	2,715	4,519	6,775	8,950	38.4
Subscribers: thousands	4,020	5,235	7,536	10,043	14,778	18,100	35.1
Network Equipment:							
Annual Sales: $ millions	1,000	1,500	2,500	4,277	4,978	5,533	40.8
Systems on Line: Number	575	590	600	600	605	605	1.0
Service Revenue: $ millions	3,010	3,855	4,575	7,326	10,573	14,328	36.0

* Compound Annual Growth Rate

(p) Projection

Source: NATA Market Research Department

INTERNATIONAL DEVELOPMENTS

INTERNATIONAL DEVELOPMENTS

The U.S. telecommunications marketplace can no longer be evaluated in isolation. It is but one piece of a dynamic global collage where industry participants span national borders and multilateral and bilateral trading blocs are creating huge new markets and tremendous opportunities for growth. Developments in U.S. foreign trade policy, as well as the economic integration of the European Community, economic and political changes in Eastern Europe and the Soviet Union, and a general international trend toward stimulating competition in telecommunications markets have profound implications for industry players.

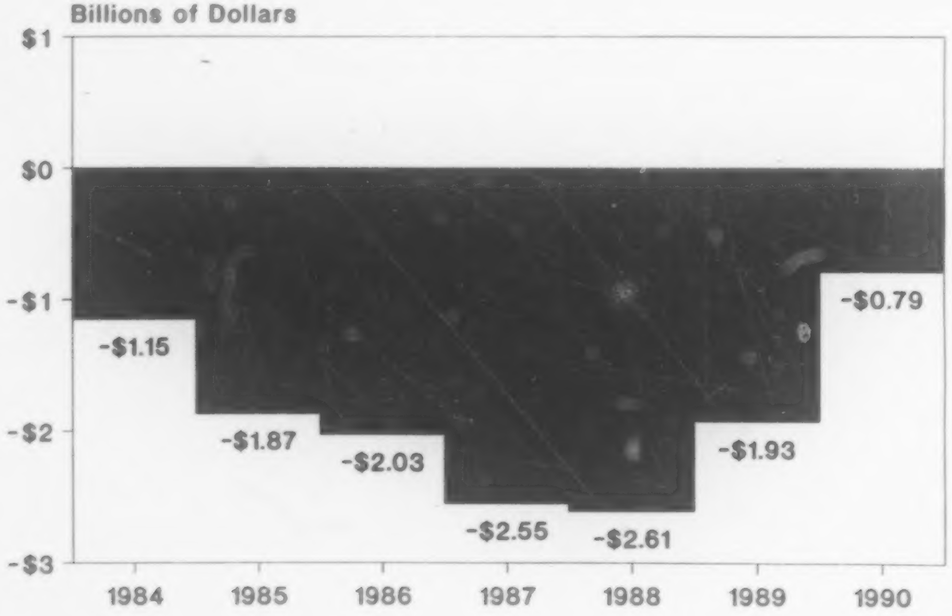
U.S. Foreign Trade Activities

Overview

International trade in merchandise has become very important to the health of the U.S. economy over the past decade. Not very long ago, trade turnover (imports plus exports) accounted for less than five percent of the gross national product (GNP). In 1990, trade turnover accounted for over 15 percent of GNP. As international trade — both imports and exports — becomes more critical to the U.S. economy, the problems of managing our trading relationships become more difficult. In a nation such as the United States, built on free enterprise in goods and services, the concept

Fig. 72

U.S. Trade Balance In Telecommunications Equipment, 1985-1990



Source: U.S. Department of Commerce

of hands-on management of trade becomes a thorny issue.

Because the United States is generally oriented toward free trade and has relatively low barriers to imports, foreign producers are able to sell successfully here. The reciprocal, however, is often not true, and U.S. producers are frequently not given the same market opportunities abroad. The U.S. suffers trade imbalances caused not by economic factors such as comparative advantages in raw materials, etc., but by parochial political concerns. These imbalances are behind much of the current political pressure on the U.S. government to take a more active role in managing trade relations.

Political concerns can outweigh economic concerns in international trade in telecommunications. The United States maintains a relatively open and competitive marketplace for most types of telecommunications products, especially those used by consumers and businesses, and imported products have done well. In many foreign countries, however, U.S. producers have found barriers to trade. As a result, the U.S. trade balance in telecommunications equipment worsened from minus $1.2 billion in 1984 to minus $2.6 billion in 1988 before improving to minus $792 million in 1990 (Fig. 72, page 167). This improvement is the result of increased efforts of U.S. manufacturers to tap emerging markets abroad, coupled with aggressive U.S. negotiators pressing for increased U.S. market access abroad. A continuing bright spot remains the trade surplus with the European Community, which increased from $326 million in 1987 to $1.1 billion in 1990.

Clearly, the trend in U.S. trade patterns reflects the types of products U.S. producers manufacture, the openness of foreign markets, the openness of the U.S. market, and the international economic climate. U.S. producers manufacturer mainly high-end, high-technology products. U.S. producers have been relatively successful both here and abroad with those products. Import penetration in the U.S. marketplace is principally in low-end, consumer-oriented products. For the most part, this segment has been abandoned by U.S. producers as relatively unprofitable.

International trade in telecommunications equipment depends on a variety of factors. Exchange rates, customs duties, historical trading relationships, and general economic conditions are significant determinants of international trade. Until recently, changes in the exchange rate, for instance, have tended to stimulate U.S. exports. Since 1984, the U.S. dollar has decreased by almost 40 percent in value against a composite, trade-weighted average of the currencies of our major trading partners. The dollar has recently begun to edge up vis-a-vis the currencies of our major trading partners; nonetheless, U.S. exports continue to hold a relatively good price position abroad.

Beyond these factors, one of the most important determinants of trade in telecommunications is government intervention. In most countries around the world, government-owned telecommunications authorities provide telecommunications services to the public. These companies, frequently called PTTs (Post, Telephone, and Telegraph), are the largest, and sometimes the only, major purchaser of telecommunications equipment within their countries. PTTs usually favor domestic suppliers and foreclose international competition. Nontariff barriers erected by the government, such as stringent certification procedures, import licenses, subsidies, etc., limit foreign participation in the local telecommunications equipment market. The situation is beginning to change, however, as PTTs start to liberalize their purchasing decisions.

Managing Telecommunications Trade

Because the U.S. economy relies heavily on free-market mechanisms, the U.S. government's management of trade does not represent a coherent industrial policy. It is, instead, a system of *ad hoc* reactions to specific problems. Consequently, trade management is fragmented and cumbersome and involves competing interests. There are 17 Congressional subcommittees responsible for creating a framework for trade policy for telecommunications, within which ten executive agencies operate.

The executive agencies responsible for most of the governmental activities regarding trade in telecommunications are the Office of the U.S. Trade Representative (USTR); the Departments of Commerce, State, Treasury, Defense, and Justice; the International Trade Commission (ITC); the Small Business Administration; the Export-Import Bank; and the International Development and Cooperation Agency. Together, these agencies manage the day-to-day responsibilities of ensuring that U.S. trade policy stimulates the competitiveness of U.S. industries through the management of trading relationships that are not always based on reciprocal market opportunities.

Several recent activities highlight the complexity of U.S. telecommunications trade policy. The AT&T dumping case provides insight into how the Department of Commerce (Commerce) and ITC conduct an antidumping investigation. In essence, the procedure, which took more than a year to complete, required Commerce and ITC each to conduct two investigations to determine whether to impose dumping duties on imports of small business telephone systems from Japan, Korea, and Taiwan. The case was completed in early 1990 and represented a victory for AT&T and Comdial. At that time, all imports of small business telephone systems from Japan and Korea and certain products from Taiwan became subject to dumping duties. The duties are very high for Japanese- and certain Taiwanese-made products; the margins are fairly low for imports from Korea.

The impact of this decision has been a redistribution of market share among the major players. In the short term, prices for small business phone systems have stabilized and even inched up a bit, perhaps as much as five to ten percent. That increase will be short lived, however, and by mid-1991 prices will begin to fall. The main losers are the small Japanese producers and their U.S. distributors, which will be subject to high dumping duties and do not have the resources to shift production to the United States or to a third country.

Other significant developments include the enactment of the Omnibus Trade and Competitiveness Act of 1988. This act targets telecommunications as a strategic industry and has imposed various measures to ensure that U.S. producers are afforded the maximum import relief in the U.S. market within the bounds of a relatively free trade environment. In addition, the act attempts to ensure, to the extent possible, greater market access abroad for U.S. industry. As part of this effort, the USTR is required to review existing trade agreements, including a 1986 agreement with Japan designed to open access to the Japanese market to U.S. companies. On May 8, 1989, the USTR found that the Japanese had not lived up to the agreement and threatened punitive actions. At the eleventh hour, the Japanese sent a negotiator and the issue was resolved.

On January 1, 1989, the United States and Canada began implementation of an historic free trade agreement crafted to eliminate virtually all barriers to trade between the two countries within ten years. In telecommunications this will happen more quickly, with most trade barriers to be eliminated within five years. This agreement will provide significant advantages to producers of equipment and services on both sides of the border, since common telecommunications network standards already exist, and virtually no adaptations are required.

Other important developments include the United States' participation in various international forums that have as their goals the global harmonization of telecommunications standards, trade policy coordination with the aim of reduced trade barriers, cooperation in international financial and economic policy matters, and a general trend toward increased economic and political interdependence. These forums include the General Agreement on Tariffs and Trade (GATT), the International Telecommunications Union (ITU), the Organization for Economic Cooperation and Development, and other similar organizations.

U.S. trade policy is based on the notion of free access to U.S. markets in return for access to markets abroad. Despite occasional setbacks, the global trading environment is gradually becoming more fair and open as governments around the world realize that economic gains can be achieved through freer competition. This trend bodes well for U.S. producers, since they already operate in a highly competitive domestic environment and can translate that experience to markets abroad. With the right mix of products, management insight, and strategic goals, U.S. companies should be able to capitalize on the emerging global marketplace and make significant inroads into areas once considered impenetrable.

Implications of U.S. Policies

International trade in telecommunications has become a top issue in government trade regulation policy forums and is being debated at the highest levels of government. There are two seemingly divergent trends in government attitudes towards the management of trade. Trade idealists want no management of trade whatsoever. More pessimistic telecommunications trade analysts argue that the U.S. has already made tremendous unilateral concessions with the divestiture of AT&T. As a result, trade needs to be heavily managed to maintain for U.S. producers the portions of the market in which they can still compete. There are signs of both trends, but the synthesized policy that has developed represents a basically pragmatic approach to trade: the management of trade to the extent necessary to achieve the maximum economic benefits possible to all parties, given that the international trading environment is frequently determined by political rather than economic concerns. In essence, U.S. policy has evolved based on trying to reduce U.S. trade imbalances caused by an inequitable trade environment.

Several of our trading partners are becoming disillusioned by our seeming ambivalence with respect to the implementation of telecommunications trade policy. Two cases in point are Japan and the European Community (EC).

The U.S. has made Japan the object of virtually every conceivable trade action. As a result, despite the fact the United States is by far their biggest customer, the Japanese are becoming as frustrated with the trade relationship as we are. In addition, the political climate in Japan has begun to change, suggesting a more protectionist and less conciliatory trade environment. It seems likely, therefore, that the trade relationship between Japan and the U.S. will not improve in the near term.

An out-and-out trade war is not likely, however. Each country has too much economic interest vested in the other. We are dependent on the Japanese for financing our national debt. Moreover, we depend on them for certain strategic products no longer manufactured in the United States, especially electronic components. The Japanese depend on us as the biggest market for their products and the safest and most profitable haven for their excess cash.

The European Community is undergoing one of the most significant economic upheavals in its history — integration into a single market (see following section). In the best of times, the U.S./EC trade relationship has been less than harmonious. Most of the transatlantic arguments have been over agriculture, but the EC countries have shown that they are not immune to trade friction over a variety of products. The United States has recently named the EC as a priority body for negotiations in telecommunications trade issues. The Europeans have indicated that they view our reasons for targeting them as groundless. With the integration of the EC economies, the Europeans will represent the largest single market in the world and will have even less incentive to defer to us. Still, the overall relationship will probably remain relatively smooth, since there are too many vested economic and political interests to allow the relationship to become too stormy.

Despite the possible risks of this pragmatic approach to trade management, the global trading environment is probably on an upswing in terms of cooperation and barrier reductions. The three most hopeful signs are the U.S./Canada Free Trade Agreement; the removal of the barriers between the EC countries (unthought of, even as a remote possibility, not long ago); and the Uruguay Round of trade negotiations (a new round of multilateral trade negotiations under the auspices of the GATT), originally due to be completed by year-end 1990. In December 1990, the GATT talks broke down, but were resumed in early 1991. These signs point to a global economy that is becoming more and more interdependent.

1992 Economic Integration of the European Community

The marketplace for telecommunications equipment in the European Community (EC) is in a state of profound change. The blueprint of that change, the Green Paper issued by the Commission of the EC in June 1987, envisions a very sophisticated, highly integrated, pan-EC telecommunications marketplace as a cornerstone of EC 1992, the historic plan to integrate virtually all aspects of EC economic activity.

The Green Paper proposes to eliminate barriers to intra-EC telecommunications services and telecommunications equipment sales. In addition, the Green Paper explicitly calls for the conversion of the telecommunications market-place to a market driven by competitive forces. Achieving these aims would represent a reversal of traditional policies, under which EC members have developed their own telecommunications networks with little regard to coordination across national borders.

It is clear that as the world becomes a smaller place in which to do business, international competitiveness will depend on the ability to reach global markets. Businesses will rely increasingly on sophisticated integrated telecommunications networks to track supplies from foreign sources, communicate with far flung branch offices, court and service customers around the globe, and coordinate worldwide marketing.

To meet that challenge, the EC is adopting the goals of the Green Paper to place the EC telecommunications infrastructure at the forefront of technology and strengthen the global competitiveness of EC telecommunications suppliers. To achieve this goal, however, many obstacles, such as including ingrained nationalism, divergent cultures, language barriers, and bitter feelings from past military struggles, must be overcome..

In telecommunications, the situation is about as difficult as it could be. The indigenous telecommunications service providers, usually PTTs, have traditionally guarded their fiefdoms by allowing no competition in services and, through coddling domestic suppliers, little competition in equipment. Their mandate has typically transcended providing cost-effective telephone service to reach into the realm of politics and social ideologies.

All this has produced a fragmented marketplace, incompatible networks, great inequalities in infrastructures, disparities in service pricing, and inefficient domestic equipment producers and service providers. In essence, the EC integration of European telecommunications is scattered with land mines.

There is hope, however. There are glimmers of positive achievements. Newly introduced pan-European digital cellular and paging appear to be on the brink of success. The EC seems to be fairly far along in the implementation of pan-EC ISDN as well. Where new technology can be adopted *en masse*, the Europeans seem to collaborate well. Many of the problems lie in patching together existing data and voice networks. Slowly but surely, even these problems will be resolved.

Due to the many technical, economic, legal, and political challenges, it is clear that full integration of European telecommunications will not occur until after 1992.

When integration is achieved, however, the results will be well worth the struggle. In 1992, the integrated EC telecom equipment marketplace is expected to amount to $33.2 billion and to be the second largest market in the world, accounting for more than 25 percent of worldwide sales. By 1995, with rapid growth expected, the size of this market will reach some $41.0 billion and may surpass the U.S. market as the largest in the world.

This explosive demand for equipment and services is being sparked by the reunification of Germany, a mass migration of foreign companies to European soil to access the world's largest marketplace, and Spain's 1992 hosting of both the Olympics and the World Trade Fair. Moreover, European companies are preparing for the onslaught of foreigners and are sharpening their own competitiveness for a unified EC marketplace, sometimes with the help of outsiders. For example, GE Information Services manages a data network for Italian clothing retailer Benetton. The network links offices of 35 regional agents to 12 manufacturing plants in Italy, France, Spain, and Great Britain.

The fastest growing markets will be in nations with the most antiquated networks. Accordingly, Ireland, Portugal, Spain, and Greece will experience some of the most rapid growth rates through 1992 and beyond.

In terms of product areas, the largest markets will be for central office switches at $6.8 billion by 1992 and transmission equipment at $5.6 billion. The transmission equipment market will experience the most rapid growth, rising to $8.0 billion by 1995. Other important equipment markets will include mobile communications at $4.4 billion by 1992, cables at $4.1 billion, data communications equipment at $2.9 billion, fax systems at $2.6, and PBXs at $2.4 billion.

The major players in the European marketplace will be those who work aggressively to support the market long term. Most likely, indigenous suppliers such as Siemens, Alcatel, Ericsson, GEC, Philips, and Italtel will continue to dominate, but there will be plenty of room for others. The most promising prospects for non-European suppliers will be in the business market. Telecommunications users, including increasing numbers of U.S.-based multinationals accustomed to sophisticated telecommunications capabilities in the United States, are generally dissatisfied with PTT offerings and are looking for more sophisticated products and services at competitive prices.

Whether or not an increase in external barriers will accompany a reduction in internal barriers is definitely open to debate. The U.S. government has been aggressive in trying to ensure that the often-prophesied Fortress Europe will not become a reality. Signals are mixed on how successful these efforts have been, and it is clear that much remains to be done to ensure that there is no increase in external protectionist measures at the same time that internal barriers are dropped.

In discussions on the openness of the EC market to foreign firms, the Europeans have expressed concern over a number of U.S. initiatives they claim may inhibit EC exports to the U.S. market. Among these is the movement on some fronts to modify the terms of the AT&T consent decree to allow the Regional Bell Operating Companies to manufacture telecommunications equipment. The EC has also expressed concern over some of the provisions of the 1988 Omnibus Trade Act. While this is clearly a strategy to strengthen their negotiating position, the EC claims it does not want to throw open the doors to the EC market if the doors to U.S. market are being closed.

Regardless of how these discussions are concluded, and irrespective of official policies, an ingrained European bias will continue toward buying products made in Europe or, at a minimum, buying from a company with extensive investment in Europe. This bias will be especially prevalent in public agencies. This leads many experts to recommend that companies interested in exploiting the rich opportunities that will develop to make as much of a commitment to Europe as possible. This might include direct foreign investment, joint venturing, or licensing agreements.

A new order is clearly emerging in Europe. Despite monumental challenges, the EC understands that a common, sophisticated telecommunications infrastructure is essential to overall economic integration and growth. Integration will happen, if not by 1992, then perhaps by 1995. Whenever and however it occurs, it will be a marketplace that cannot be ignored.

Implications of Political Changes in Eastern Europe

The years 1989 and 1990 witnessed a metamorphosis in Eastern Europe. In virtually every country, the traditional Communist government has been rejected and movement has begun toward democratic and market-oriented reform. This will have profound implications on East-West relations within Europe. Once subject to extreme restrictions on trade of high technology products by most western nations, Eastern Europe is becoming much less of a security threat. As a result, the multinational Coordinating Committee (COCOM) which establishes export controls to Eastern Bloc countries has significantly relaxed restrictions in recent months. This will lead to new economic ties between the trading blocs.

Political ties will also be re-formed, as demonstrated by the historic reuniting of Germany. In virtually every respect, the developments in Eastern Europe bode extremely well for East-West relations. The EC has called for several initiatives to improve relations between Eastern and Western Europe. Given the pace of change, it is not inconceivable that within a short time some of the most progressive Eastern European countries might apply for EC membership.

With the telecommunications infrastructure such an important part of economic development, East European countries are actively seeking western technology. This has stimulated many western companies to begin aggressively evaluating opportunities in Eastern Europe.

There is every reason to look covetously at the Eastern European telecommunications market. With antiquated telecommunications networks, East European countries, including the Soviet Union, may spend up to $150 billion over the next decade to upgrade their networks. Taken together, these countries may eventually represent 20 percent of the world market for telecommunications equipment. Despite the initial attraction, the Eastern European market is complicated by nonconvertible currencies, lack of funds, lingering trade restrictions, and the East European predisposition to barter. Telecommunications suppliers interested in that market may have to be willing to swap telecommunications equipment for plywood, vodka, or even livestock. In addition, the Eastern European countries are hardly homo-geneous in political, cultural, and economic characteristics, and their telecommunications infrastructures differ markedly. Czechoslovakia is considered to have the best telephone network of the Eastern Bloc, despite a relatively low penetration rate of 12.5 phones per 100 inhabitants. Hungary has a poorer phone system but is further along in economic liberalization. Poland has an even less sophisticated telephone system, but is aggressively seeking economic ties with the West. Bulgaria has the highest penetration rate in the East Bloc, with about 18 phones for every 100 inhabitants, but has moved very slowly on economic and political reforms. The Soviet Union has the third largest telephone system in the world, with 27 million access lines, but a very low penetration rate of 11.3 phones per 100 inhabitants.

Despite the pitfalls, companies should evaluate the opportunities that do exist. A company with an aggressive, successful strategy in the EC stands a good chance of breaking into the East European markets as the economies of Eastern and Western Europe become more intertwined. This is especially true in telecommunications, where technical standards and certification policies can be strong impediments to trade. East European countries will undoubtedly be invited to join the European Telecommunications Standards Institute (ETSI) and other European standards bodies, thereby greatly enhancing technical compatibility throughout the whole of Europe.

Other International Trends

A number of other recent international developments promise to have dramatic implications for the worldwide telecommunications marketplace. Among these is the movement abroad of the Regional Bell Operating Companies (RBOCs), which are flexing their financial muscle in pursuit of diversification strategies. Feeding the RBOC hunger for overseas properties is the accelerating trend of foreign governments selling off, *i.e.*, privatizing, their telephone systems. Privatization is occurring in different countries for different reasons, but in general the predominant reasons are to infuse the government with cash (especially true in developing countries) and to stimulate competition in the telecommunications marketplace to foster a more sophisticated telecommunications infrastructure — a key ingredient in economic growth.

Feeling somewhat hamstrung domestically, where regulations limit their ability to exploit their considerable economic power fully, the RBOCs have turned their attention abroad.

All seven RBOCs have established subsidiaries to explore international ventures. The most aggressive RBOC to date has been PacTel, whose foreign ventures have been estimated at $1.5 billion. Among its investments, PacTel has a 26 percent stake in a consortium to develop a second cellular network in Germany, a 20 percent stake in Microtel Communications to build a nationwide personal communications network in Great Britain, a franchise to build a cable TV network in Britain that could ultimately reach 830,000 homes, and a 10 percent interest in a trans-Pacific fiber-optic cable consortium.

Another aggressive RBOC, US West, has foreign investments worth slightly over $1.0 billion. With partners, US West holds cable TV franchises in Hong Kong, Britain, and France that represent a potential six million subscribers. US West also has a 30 percent equity interest in Unitel, a consortium to develop a personal communications network in the U.K. The company also owns 49 percent of a cellular project in Hungary and is co-leader of a consortium that is trying to build a fiber optic backbone through the Soviet Union. (The U.S. Department of Commerce has ruled that this project violates COCOM regulations, but US West is appealing.)

BellSouth has also been active. To date, its foreign ventures are worth some $550 million. The company has cellular interests in Argentina, Uruguay, France, Britain, Switzerland, and Mexico, paging interests in Australia, Britain, and Switzerland, and cable TV interests in France. Other BellSouth foreign ventures include software and network modernization consulting and equipment distribution.

NYNEX foreign operations are worth some $330 million. They include a 50 percent interest in the telephone system of Gibraltar, cable TV interests in Britain, and software and telecommunications consulting activities around the world.

Until recently, Bell Atlantic's foreign activities were fairly minimal, amounting to some $120 million. However, it has recently stepped up its international activities and, along with Ameritech, has acquired a 90 percent equity interest in New Zealand's telephone company. Bell Atlantic also signed a contract to act as partner with US West to provide cellular systems and packet switch networks for data transmission in Czechoslovakia. In addition, several Russian urban centers have been authorized by the U.S.S.R. to negotiate with Bell Atlantic regarding cellular service offerings.

Southwestern Bell has pursued a modest policy abroad and has made foreign investments worth about $100 million to date, principally in cable TV interests in Britain and Israel. The company has also been active in overseas equipment sales and directory publishing.

Ameritech has been the least active of the RBOCs, and the last to organize a subsidiary to concentrate on foreign opportunities. To date, its international investments are worth about $20 million, chiefly in voice messaging service bureaus in Western Europe and Japan. Ameritech appears poised to become more aggressive, as witnessed by its recent joint venture to acquire majority interest in New Zealand's telephone system with partner Bell Atlantic.

Other opportunities are bound to pique the interests of the RBOCs, as some 27 countries around the world plan to completely or partially privatize their telecommunications networks. Estimates are that the total investment value of these networks exceeds $145 billion. In Central and South America, Argentina, Mexico, Puerto Rico, Venezuela, Colombia, Brazil, and Paraguay all plan to sell at least partial interest in their telephone networks by 1994. In Western Europe, countries actively considering privatization include Portugal, Sweden, Ireland, the Netherlands, Denmark, Belgium, and Germany. In Eastern Europe, they include Hungary, Czechoslovakia, and Poland. In the Middle East, Israel, Saudi Arabia, and Turkey plan to privatize their networks.

Elsewhere, South Africa, Kenya, Nigeria, Malaysia, Singapore, and South Korea have all announced that some form of privatization will occur within the next few years. These countries have witnessed the privatization and deregulatory trends of the United States, Great Britain, Japan, and, most recently, New Zealand and have concluded that private investment in network operators can stimulate investment in the nation's telecommunications infrastructure while at the same time bringing in much needed revenue to the government.

Table 41

U.S. Imports of Telecommunications Equipment, 1985-1990

(thousands of dollars)

Country	1985	1986	1987	1988	1989	1990
European Community:						
Belgium and Luxembourg	553	753	691	4,365	3,759	1,229
Denmark	4,234	3,262	2,309	4,047	5,257	4,395
France	94,490	41,181	73,549	130,556	109,667	96,896
Germany, West	49,772	44,891	49,761	73,260	103,236	103,897
Greece	792	1,741	1,178	1,671	2,598	1,762
Ireland	4,702	7,922	7,786	7,570	9,924	12,577
Italy	21,641	17,572	42,938	43,280	23,096	17,071
Netherlands	18,362	14,137	6,793	37,649	20,765	7,348
Portugal	25	20	189	94	170	151
Spain	14,516	14,367	2,417	1,340	7,310	2,376
United Kingdom	46,641	64,774	55,050	66,482	98,698	113,201
Total EC	55,728	210,617	242,662	370,315	384,300	360,903
East Asia						
Hong Kong	197,651	307,026	342,966	471,307	403,595	336,278
Japan	2,008,603	2,051,689	2,388,546	2,484,012	2,672,112	2,375,016
Korea, South	233,553	337,032	512,019	515,578	482,877	387,118
Singapore	207,579	260,861	355,364	500,648	480,319	467,962
Taiwan	458,127	586,783	721,127	[illegible]8,288	612,376	585,097
Total East Asia	3,105,512	3,543,393	4,320,022	4,669,833	4,651,279	4,149,421
Canada	549,711	483,193	453,317	616,517	275,030	320,293
Mexico	196,634	209,484	238,884	259,626	275,030	320,293
World	4,357,547	4,738,921	5,614,387	6,449,411	7,116,047	7,126,405

Note: Columns may not add due to rounding.

Source: U.S. Department of Commerce

Table 42

U.S. Exports of Telecommunications Equipment, 1985-1990

(thousands of dollars)

Country	1985	1986	1987	1988	1989	1990
European Community:						
Belgium and Luxembourg	20,020	27,670	20,699	38,567	38,207	37,428
Denmark	11,778	4,989	7,243	8,603	13,086	23,420
France	44,075	38,472	42,678	60,297	80,214	100,145
Germany, West	102,228	108,821	103,587	128,412	137,792	354,784
Greece	3,745	4,284	9,125	23,113	10,243	9,557
Ireland	8,181	8,797	8,315	10,074	10,900	16,059
Italy	36,120	35,976	44,850	71,202	103,444	148,818
Netherlands	71,267	83,626	79,051	90,691	90,299	103,562
Portugal	1,899	5,248	6,394	10,807	10,793	9,612
Spain	30,778	21,286	21,841	32,946	62,668	83,532
United Kingdom	179,347	191,245	225,381	313,099	627,223	535,160
Total EC	509,438	530,413	569,166	787,814	1,184,852	1,422,076
East Asia						
Hong Kong	39,560	49,291	58,761	92,927	120,583	105,837
Japan	106,185	138,655	175,485	263,151	528,135	576,492
Korea, South	132,989	103,707	68,321	151,906	183,109	221,942
Singapore	32,573	36,127	65,335	87,355	88,949	140,359
Taiwan	84,926	101,191	173,754	188,218	224,218	408,198
Total East Asia	396,233	428,972	541,656	783,557	1,144,994	1,452,829
Canada	246,547	250,790	331,740	431,911	571,847	663,366
Mexico	313,978	373,829	415,167	579,898	522,416	746,850
World	2,491,245	2,708,351	3,064,600	3,841,033	5,080,602	6,334,490

Note: Columns may not add due to rounding.

Source: U.S. Department of Commerce

Index

Index

A

Access Lines in United States, 7

Adds, Moves, and Changes, 87

Alabama, 140

Alcatel, 172

American Public Communications Council (APCC), 141

Ameritech, 37, 39,40, 100, 143, 175

Answer Supervision, 141

Answering Machines with Centrex, 77

Applications, Computer-Switch, 106

Argentina, 175

Arkansas, 140

Asynchronous Terminal, 125

AT&T, 4, 8, 74, 76, 83, 95, 104, 135, 137, 140, 146,147, 160

AT&T Divestiture, 3, 7, 37, 75, 77, 95, 170

AT&T Dumping Case, 6, 106, 169

Australia, 175

Auto Dialers, 137
  with Centrex, 77

Automated Attendants, 75, 134, 137

Automated Call Distribution Sales, 88

Automatic Call Distributor Market, 137

Automatic Call Distributors (ACDs), 75, 134
  with Centrex, 77

B

Banking Installed Base of Centrex, 100

Basic Rate Interface (BRI), 74

Bearer Channels, 74

Belgium, 176

Bell Atlantic, 37, 100, 141, 175

Bell Operating Companies (BOCs), 37

BellSouth, 37, 161, 175

Benetton, 172

Brazil, 175

Bulgaria, 174

Business Sector Facsimile Usage, 131

Business Services Usage, Cellular, 161

Business Telecommuniations Services Market, 36

Business Telecommunications Market, 5

Business Telecommunications Market (European), 173

Bypass, 38

Bypass Revenue Loss (RBOCs), 39

C

Cable Market (European), 172

California, 40, 141

Call Accounting System Sales, 86, 88

Call Accounting Systems, 75

Call Accounting with Centrex, 77

Call Scanning and Rating, 141

Canada, 4, 169, 171

Canon, 131

Carterfone Decision, 83

Cellular Market Carriers, 161
  Phones, Usage, 161

- Radiotelephony, 157
- Service Market, 21
- Subscribers, 159
- Systems Annual Capital Investment, 160
- Telephone Prices, 159
- Telephone Systems Market, 6

Cellular, Digital (European), 172

Centel, 37

Central America, 175

Central Office Switch Market, 7

Central Office Switch Market (European), 172

Central Office Switch, Manufacturer Shipments, 13

Centrex, 6, 73, 74, 75, 95
- Compared to PBX, 96
- CPE, 77
- CPE, Total Annual Sales, 77
- Distribution Channels, 96
- Equipment Sales, 100
- Installed Base by RBOC, 100
- Market, 36
- Tariffs, 95
- with Answering Machines, 77
- with Auto Dialers, 77
- with Call Accounting, 77
- with Intercom Service, 95
- with Key Systems, 77
- with Paging Systems, 77

Cellular Systems Service Revenue, 160

Codec, 146

Coin Lines, 141

Colombia, 175

Comdial, 169

Common Carrier Line Equipment, Manufacturer Shipments, 14

Communications Industry Usage, Pagers, 161

Comparably Efficient Interconnection (CEI), 40

Competitive Payphone Industry, 140

Competitive Payphone Installed Base, 142

Competitive Payphone Providers Compensation, 141

Compression Concentrators, 126

Computer Dealers, 127

Computer Work Station Sales, 88

Computer-Switch Technologies, 105

Concentrator Market, 126

Concentrators, 125,126

Connecticut, 140

Construction Industry Usage
- Cellular, 161
- Pagers, 161

Consultive Committee International Telegraph, 130

Consumer Price Index, 102
- for Interstate Toll Rate, 22
- for Intrastate Toll Svc, 22
- for Local Service, 22
- for Telephone Service, 22

Contel, 4, 37, 161

Coradian, 4, 83

Corporate Telecommunications Budgets, 4

Cost of Equipment to CPE Distributor, 86

Cost of Operations as Share of Net Sales, Service, 23

Credit Card Calling, 140

Credit Card Validation, 125

Current Ratio for Communications Equipment Manufacturers, 15

Customer Premises Equipment (CPE), 73

  Distributor Expenses, 86
  Distributor Revenue Sources, 85
  Distributors, 85
  Market, Factors Affecting, 6
  Sales, 85
  Sales Through Systems Integrators, 75
  Vendors, 84

Czechoslovakia, 174, 176

D

Data Communications Equipment, 73
  Manufacturer Shipments, 13
  Market, 5, 74, 125, 126
  Market (European), 172

Data Communications Networks, Expansion in, 22

Data Communications Product Distribution Channels, 127

Data Communications Services Market, 21

Data Terminals, 74

Data Transmission (ISDN), 23

Denmark, 176

Department of Commerce, 169, 175

Department of Defense, 5, 169

Department of Justice, 169

Department of State, 169

Department of the Treasury, 5, 169

Department of Transportation, 5

Digital
  Architecture, 74
  Centrex Switches, 95
  CO Switches, 7
  PBXs, 102, 125
  Private Lines, Expansion in, 22

Digitization, 3, 126

Domestic Network Traffic, 7

Dumping Duties, 169

E

Eastern European Market as Percent of World Telecommunications, 174

Eastern Europe, 173

Electromechanical Centrex Switches, 95

Electronic Funds Transfer, 125

Electronic Mail, 125

End User Installed Base of Centrex, 100

Enhanced Services, 40

Equipment in Telecommunications Budget, 22

Ericsson, 105, 172

European Community (EC), 170, 171

European Community, Trade Balance, 168

European Telecommunications Standards Institute (ETSI), 174

Exchange Access Services, 35

Exchange Rate on U.S. Dollar, 168

Exchange Services, 35

Export-Import Bank, 169

F

Facilities Management Software, 75

Facility Bypass, 38, 39

Facsimile
  Boards, 131
  Distribution Channels, 130
  End User Segments, 131
  Equipment, 73
  Group Markets, 130
  Groups, 130
  Integration with Voice Processing, 138
  Manufacture, 13
  Sales through CPE distributors, 130

  Servers, 131
  Systems Market (European), 172
  Switches, 131
  Terminal Installed Base, 131
  Terminal Market, 6,129, 130
  Terminal Sales, 88
  Terminals, 74, 75
  Transmission, 129
  Transmission Standards, 130

Factory Shipments of Telecom Equipment, 13

Federal Government Telecommunications Budget, 22

Fiber Optics Market, 7

Financial Outlook, CPE Distributors, 87

France, 172, 175

Free Trade Agreement (Canada), 4, 169, 171

Front End Processors, 125, 136, 127

Fujitsu, 104

G

GE Information Services, 172

GEC, 172

General Agreement on Tariffs and Trade (GATT), 4, 170,171

Germany, 172, 175, 176

Gibralter, 175

Government Intervention in International Trade, 168

Government Sector Centrex Installed Base, 100

Government Sector Facsimile Usage, 131

Gray, William, 140

Great Britain, 172, 175,176

Greece, 172

Green Paper (European Community), 171

Gross Profit Margins, CPE Distributors, 86

Group 4 Facsimile Terminals, 74

GTE, 4, 37, 141, 161

H

H.261, 147

Hawaii, 140

Hong Kong, 159, 175

Housewives' Usage, Cellular, 161

Hungary, 174,176

Hybrid Key Sales by CPE Distributors, 117

Hybrid Systems, 73

Hybrid/Key Distribution through RBOCs, 117

Hybrid/Key Manufacturer Direct Sales, 117

Hybrid/Key Market, 116

I

IBM, 147

IBM/ROLM, 104

Image Transmission (ISDN), 23

Independent Interconnect Sales of PBX Equipment, 98

Independent Telephone Company Sale of PBX Equipment, 98

Indiana, Tariffs, 40

Information Services Market, 21

Installed Base, PBXs, 98

Insurance Companies Telecom Budget, 22

Integrated Services Digital Network Market (ISDN), 8

Integrated Services Digital Network (see also, ISDN), 3, 6, 15, 23, 38, 39, 73, 84, 95, 98, 102, 126

Interactive Voice Response System, 134

Intercom Sales, 88

Intercom Service with Centrex, 95

Interconnection with Service Network, 23

Interconnects, Data Communications Distribution, 127

Interexchange Companies (IXCs), 7

International Development and Cooperation Agency, 169

International Telecommunications Union (ITU), 170

International Trade as Percentage of GNP, 167

International Trade Commission (ITC), 169

International Trade Management, U.S., 169

International Trade, Factors Affecting, 168

Ireland, 172, 176

Iridium, 159

ISDN (European), 172

ISDN Lines in Place, 39

ISDN, with Key Systems, 115

ISDN-Related Equipment Market, 3

Israel, 175,176

Italtel, 172

Italy, 172

J

Japan, 3, 4, 6, 106, 169, 170, 175, 176

K

Kenya, 176

Key Systems Market, 6

Key Systems, 73, 75
    with Centrex, 77
    with ISDN, 115
    Sales, 85

Key/Hybrid
    Features, 115
    Installed Base, 117
    Market, 114
    Penetration by Industry, 118

Korea, South, 6, 106, 159, 169, 176

L

Labor Costs, CPE Distributors, 86

Lease Payments in Telecommunications Budget, 22

Least Cost Routing Sales, 88

LEC Tariffs, 39

LEC-Owned Payphone Installed Base, 142

Line Charges in Telecommunications Budget, 22

Local Access and Transport Areas (LATAs), 35

Local Area Network Bridges, 74

Local Area Networks (LANs), 7, 74,75, 126
    Market, 127
    Sales, 88

Local Exchange Access, 95

Local Exchange Carriers (LECs), 7, 35, 37

Local Exchange Carriers, Revenue of, 7

Local Exchange Services Market, 21, 36

Local Government Telecommunications Budget, 22

Long Distance
    Market, 8
    Service, 75
    Service Market, 21
    Service Sales, 87
    Usage, Expansion in, 22

Long Distance Carriers' Expenditures, 4

Long, George, 140

M

Mail Order Houses, Data Communications Distribution, 127

Maintenance in Telecommunications Budget, 22

Maintenance Termination Unit Testing, 141

Malaysia, 176

Managerial Personnel Usage, Cellular, 161

Manufacturer
  Acquisition of Distribution Channels, 102
  Cost of Materials, 14
  Direct Facsimile Distribution, 130
  Direct Sales Force, Data Communications, 127
  Direct Sales of PBX Equipment, 98
  Distribution Channels, 104
  Inventories, 14
  Market Shares, Secondary Equipment, 76
  Support for Secondary Market, 76
  Wages as Share of Total Shipments, 14

Manufacturing Facsimile Use, 131

Manufacturing Industry Usage, Cellular, 161

Manufacturing Installed Base of Centrex, 100

Market Penetration of Payphones, 143

McCaw, 161

MCI, 4, 8

Mergers and Acquisitions, 4, 161

Mexico, 175

Microtel Communications, 175

Mitel, 4, 76, 104

Mitsubishi, 160

Mobile Cellular Telephones, 159

Mobile Communications Market (European), 172

Mobile Radio Communications Equipment, Manufacturer Shipments, 14

Modems, 74, 125

Modems Market, 126

Motorola, 159, 160, 162

MS-DOS, 147

Multiplexer Market, 126

Multiplexer Sales, 88

Multiplexers, 74, 125

Multitone, 162

Murata, 131

N

NCR, 4

Nebraska, 40

NEC, 76, 83, 104, 160, 162

Netherlands, the, 176

Network Controllers, 125

New Mexico, 40

New York, 40

New Zealand, 175, 176

Nigeria, 176

Non-Sent-Paid intraLATA Calls, 141

Noninteractive Voice Response System, 134

Northern Telecom, 4, 76, 104, 116

NYNEX, 37, 175

O

Octel, 135

Office Supply Dealers, Facsimile Distribution, 130

Oki, 160

Oklahoma, 140

Olympics, 1992, 172

Omnibus Trade and Competitiveness Act of 1988, 169, 173

Open Application Interfaces, 104

Operator-Assisted 0+ Calls, 141

Organization for Economic Cooperation and Development, 170

Overhead Expenses, CPE Distributors, 86

Overhead in Telecom Budget, 22

P

Pacific Bell, 141

Pacific Telesis (PacTel), 37, 143, 161, 175

Packet Switching
  Equipment, 125
  Equipment Market, 126
  Nodes, 125

Pager Usage, 161

Paging Sales, 88

Paging Systems, 75

Paging Systems with Centrex, 77

Paging, Digital (European), 172

Panasonic, 131, 160

Paraguay, 175

Parts Sales, Secondary Equipment, 76

Pay Telephone, 140

Pay Telephone Council (PTC), 141

Payphone
  Equipment, 73
  Gross Annual Return, 144
  Gross Profits, 144
  Installed Base, 142
  Market, 142
  Market Penetration, 143
  Retrofitting Kits Market, 142
  Revenue, 143
  Service Market, 36

PBX-
  Annual Shipments, 98
  Compared to Centrex, 96
  Installed Base, 98
  Line Sales, 98
  Market, 6
  Per Line Prices, 102
  Profit Margins, 102
  Sales, 85, 87
  Trunk Service Market, 36

PBX-Host Computer Links, 104

PBXs, 73,75, 95

PC
  Fax Boards, 131
  Fax Boards, Manufacture, 13
  Sales, 88

PC-Based Image Capture Devices, 147

Peripheral Equipment, 84

Peripheral Sales, 86, 87, 88

Personal Communications Networks (PCN), 157

Philips, 172

Picturephone®, 146

Pixels, 146

Plain Old Telephone Service (POTS), 23

Poland, 174, 176

Portable Cellular Telephones, 160

Portugal, 172, 176

Post, Telephone, and Telegraph Companies (PTT), 168, 172

Power Protection Sales, 88

Primary Rate Interface (PRI), 74

Private Line Bypass, 39

Private Line Service Market, 36

Private Network Services, 75

Private Networks, 4

Producer Price Index
  CO Switches, 15
  Exports, 16
  Imports, 16
  Telephone Sets, 16
  All Equipment, 15

Professional Usage, Cellular, 161

Profit Margins, Changes in, 87

Profit Margins, PBX, 102

Proprietary Algorithms, 147

Public Fax, 140

Public Network Services, 75

Public Utilities Commission (PUC), 39, 141

Puerto Rico, 175

Px64, 147

Q

Quick Ratio for Communications Equipment Manufacturers, 15

R

Radio Communications Links, Manufacturer Shipments, 14

Radio Pager Market, 162

Radio Paging, 157

Radio Paging Networks, 161

Radio Shack, 162

RBOC
  Access Revenue, 37
  Bypass Revenue Loss , 39
  Centrex Promotion, 77
  CPE Distribution, 38, 84
  Local Service Revenue, 37
  Payphone Revenue, 143
  Sales of PBX Equipment, 98
  Total Revenue, 37

RBOCs in International Trade, 174

RCA, 83

Refurbished Equipment, 75

Regional Bell Operating Companies (RBOCs), 37, 77, 95, 173

Remanufactured Equipment, 76

Research and Development, 102

Research and Development Expenditures, 14

Residental Telecommunications Equipment, 73

Residential Telecommunications Market, 6

Residential Telecommunications Services Market, 36

Residential Users, Expenditures, 5

Retail Business Telecom Budget, 22

Retail Facsimile Distribution, 130

Retail Usage, Cellular, 161

Retrofitting Kits Market (Payphones), 142

Return on Equity, Manufacturers, 15

Ricoh, 131

Rockwell, 137

ROLM, 76

S

Sales Agency, 38, 40, 86,87, 96

Sales Agency Gross Profit Margin to Interconnects, 86

Sales Costs, CPE Distributors, 86

Sales Personnel Usage, Cellular, 161

Saudi Arabia, 176

Secondary Dial Tone, 141

Secondary Equipment, 87
  Gross Profit Margin, 86
  Market, 6, 73, 75,76, 84
  Sales, 86

Secondary Market Distribution Channels, 76

Security Systems Sales, 88

Service Business Telecom Budget, 22

Service Calls, 87

Service Pricing Regulation, 38

Services Industry Centrex Installed Base, 100

Sharp, 131

Siemens, 4, 104, 172

Singapore, 159, 176

Small Business Administration, 169

South Africa, 176

South America, 175

Southwestern Bell, 37, 161, 175

Soviet Union, 174

Spain, 172

Speech Recognition Devices, 137

Speed Dialing, 140

Standards, Computer-Switch, 106

State Government Telecom Budget, 22

STC, 4

Store and Forward Voice Messaging, 140

Stored Program-Controlled Electronic Centrex, 95

Stromberg-Carlson, 4

Subscriber Base, Pagers, 161

Sweden, 176

Switched Facility Bypass, 39

Switched Service Bypass, 39

Switching Equipment, Manufacturers Shipments, 14

Switzerland, 175

Syntellect, 137

Systems Integration, 73, 75, 84

Systems Integration Revenue, 75

Systems Integrators, 127

Systems Sales, Secondary Equipment, 76

T

T1 Circuit, 125

T1 Multiplexers, 125, 127

T1 Networks, 126

Taiwan, 6, 106, 169

Tariffs (LECs), 39

Tariffs, Centrex, 95

Teknekron, 137

Telecom Equipment Market (European Community), 172

Telecom Technologies, 137

Telecom*USA, 4

Telecommunications Budget, 22

Telecommunications Imports, 3

Telecommunications Network, 22

Telecommunications Network Equipment Market, 6

Telecommunications Service Infrastructure Investment, 22

Telecommunications Services Market, 21

Telegraph and Telephone Consultative Committe, 147

Telephone Calls Placed over Telecommunications Network, 22

Telephone Common Carriers, Investment Expenditures, 4

Telephone Operator Consumer Services Improvement Act, 141

Telephones in United States, 7

Terminal Adapters, 74

Text Transmssion (ISDN), 23

TIE, 83, 117

Toshiba, 160

Total U.S. Telecommunications Equipment Market, 3

Trade Balance in Telecommunications Equipment, 168

Trade Balance, European Community, 168

Trade Barriers, International Trade, 168

Trade Policy, U.S., 167, 170

Training in Telecommunications Budget, 22

Transmission Equipment Market (European), 172

Transmission Services Market, 132

Transportable Cellular Telephones, 159

Transportation Companies' Telecommunications Budget, 22

Transportation Industry Usage, Pagers, 161

Turkey, 176

U

U.S. Foreign Trade Policy, 167, 170

U.S. Government, Expenditures, 5

U.S. Sprint, 8

Uniden, 160

United States Trade Representative, 169

United States Trade Representative (USTR), 3, 169

Uruguay, 175

Uruguay Round of Trade Negotiations (GATT), 171

US West, 37, 39, 40, 175

Used Equipment, 75

Utilities Industry Usage, Pagers, 161

V

Value Added Distributors (VADs), 127

Value Added Networks (VANs), 125, 126

Value Added Resellers VARs), 127

Venezuela, 175

Video Terminals, 74

Video Transmission (ISDN), 23

Videoconferencing, 84, 146

Videoconferencing Equipment, 73

Videoconferencing Equipment Market, 148

Visual Displays, Pagers, 161

VMX, 135

Voice Mail Sales, 86, 88

Voice Mail Systems, 75

Voice Mail with Centrex, 77

Voice Messages, Paging, 161

Voice Messaging Equipment Market, 135

Voice Messaging Services Market, 21

Voice Messaging Systems, 134

Voice Processing, 84

Voice Processing Equipment, 73, 75

Voice Processing Equipment Market, 135

Voice Processing Integration with Facsimile, 138

Voice Processing Marketing, 6

Voice Processing Services Market, 138

Voice Response Systems Market, 135

Voice Response Units, 134

Voice Synthesis, 140

Voice Synthesizers, 137

Voice Terminals, 74

Voice Transmission (ISDN), 23

W

Warranties
    Refurbished Equipment, 75
    Remanufactured Equipment, 76
    Used Equipment, 75

Wholesale Sales of PBX Equipment, 98

Wholesale Supply House, Data Communications, 127

Wide Area Telecommunications Service, 36

Wireless PBXs, 104,105

World Trade Fair, 1992, 172

North
American
Telecommunications
Association

2000 M Street, N.W. Suite 550 • Washington, D.C. 20036 • 202/296-9800 • 800/538-6282 • Fax 202/296-4993